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# Radio & Electronics World

The communications, electronics & computers magazine

**Simply  
the  
Best**

**ONE NIGHTS WORK -  
A USEFUL IF OSCILLATOR  
FOR RX ALIGNMENT**

**CONSTRUCTING A 200 WATT  
LINEAR AMPLIFIER**

**UPGRADE THE BEEB  
COMPUTER FOR SPEECH**

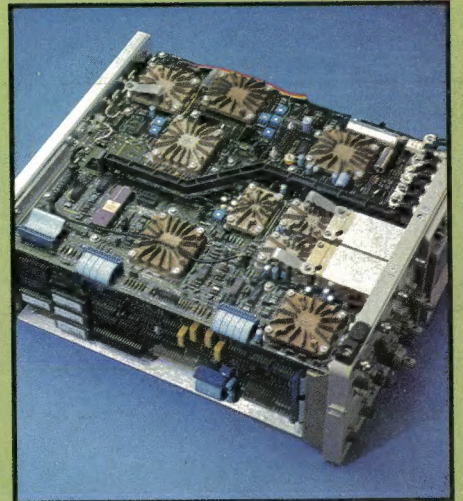
**EASY TO BUILD KEYER**

**BUILDING A 2 METRE ANTENNA -  
THE 9dB PLUS 'TIGER'**

**THE HALL EFFECT AND  
DEVICES THAT UTILISE IT**

**PAGES OF SURPLUS  
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**EXTRA  
PAGES**



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# Radio & Electronics

The communications, electronics & computers magazine

## World

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Editor ..... DENNISH HAYES

Advertisement Sales

A-O ..... ANNE BRADY  
P-Z ..... NICOLA DYER

Subscriptions ..... 01-684 3157

Accounts ..... CLARE BRINKMAN

Publisher ..... PETER WILLIAMS  
General Manager ..... ALAN GOLBOURN

ON SALE: Second Friday of the month preceding cover date

NEXT ISSUE: Cover date May 1984 on sale 13 April 1984

PUBLISHED BY: Radio & Electronics World Magazines, Sovereign House, Brentwood, Essex CM14 4SE, England (0277) 219876

PRINTED: In England

ISSN: 0262-2572

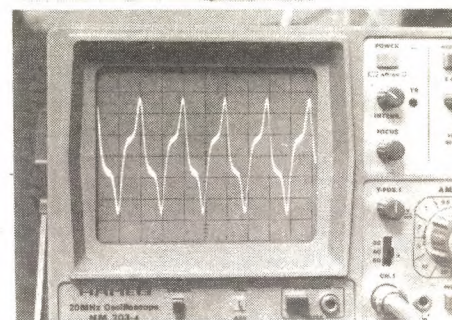
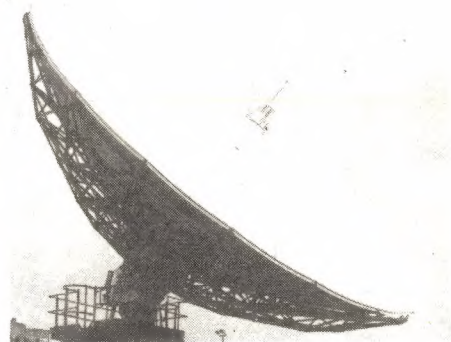
NEWS TRADE SALES BY: Seymour Press Ltd, 334 Brixton Road, London SW9 7AG Tel: 01-733 4444

### SAFETY IN THE SHACK

Some of the constructional projects described in **R&EW** and other magazines refer to additions or modifications to television receivers, communication equipment and other items that may be under guarantee by the manufacturer. Please remember that any alterations or addition to the circuit may invalidate the guarantee.

We prefer that each constructional project contains its own power supply or battery. A constructional project will occasionally describe how the power supplies of any equipment may be used to supply the circuit of that project. In these circumstances, please ensure that the power unit in the equipment is adequate to provide the additional load current that will be necessary and, in all cases, check that the equipment mains fuse is correctly rated to protect the apparatus from damage.

Safety in the shack, please, at all times. Use good practice in your constructional work as we want you to be around to enjoy **R&EW** in the future! Thank you for reading this caution, now go ahead and build one of your projects



1 Top left – Valves (MO Valve Co) 2 Top right – Spectrum analyser (Tektronix) 3 Antenna (Ant Products) 4 D/T Oscilloscope (Bridge Scientific Inst) 5 CSO 4 Amplifier (Nore Microwave)

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The views expressed by contributors are not necessarily those of the publishers.

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Radio & Electronics World Magazines



# PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News. Readers, don't forget to mention **Radio & Electronics World** when making enquiries

## BRITISH MADE FREQUENCY COUNTERS

The competitively priced Meteor Series of Frequency Counters, designed and manufactured in Britain by Black Star, is now available fitted with a Temperature Compensated Crystal Oscillator (TCXO) for extra accuracy and temperature stability.

The Meteor 1000X which measures typically from 2Hz to 1.2GHz, with <50mV sensitivity at 1GHz, features a temperature stability of  $\pm 0.5\text{ppm}$  from  $-10^\circ\text{C}$  to  $+40^\circ\text{C}$ , an aging rate of  $\pm 1\text{ppm}$  per year, and setability of  $< \pm 0.2\text{ppm}$ .

The other models in the range, the Meteor 100X (2Hz-100MHz) and the Meteor 600X (2Hz-600MHz) are available with the same TCXO. All models are battery or mains powered and are fitted with a Trigger Level Control, a Low Pass Filter and offer three Gate Times (0.1 sec, 1 sec and 10 sec).

The Meteor 'X' series of Counters are complete with mains adaptor/charger, a comprehensive instruction manual, and a year's guarantee.

A wide range of optional accessories is available.

**Black Star Limited,**  
9A Crown Street, St Ives,  
Huntingdon, Cambs. PE17  
4EB. Tel: (0480) 62440.

## IC SOCKETS

Thomas & Betts Ltd, announces a new range of IC sockets designed especially for laboratory and small prototype series use. Known as the CDF 400 series, the new sockets are available with 6 to 64 contacts and are designed so that they can be soldered above and below the PCB allowing their use with double-sided printed circuits that

have no through-plated holes. Also the cut-away moulded frame allows test probe access from both sides of the PCB. The contact material is brass plated gold on nickel.

**Thomas & Betts Limited,**  
Sedgwick Road, Luton, Beds.  
LU4 9DT. Tel: 0582 597271.

## PROM REMOVAL TOOL

A new tool manufactured by the Swedish Company Owoco AB, who are already well known for the quality DIP-IN range of IC Inserters, is announced.

The PROM-OUT makes light work of removing 24 and 40 pin ICs from Proms fitted in sockets (as distinct from soldered to the PC board). Structural damage to the PC board or IC is avoided by the design of the PROM-OUT. The force is restricted to the top of the base of the socket avoiding damage by pressure to the board and IC.

Two models are available ex stock, No. 2428 PROM-OUT for 24 and 28 Pin IC and No. 3640 PROM-OUT for 36 and 40 Pin IC.

**Welwyn Tool Co. Ltd,** 4 Black Fan Road, Welwyn Garden City, Herts. AL7 1EH. Tel: (07073) 31111.



sions to be displayed.

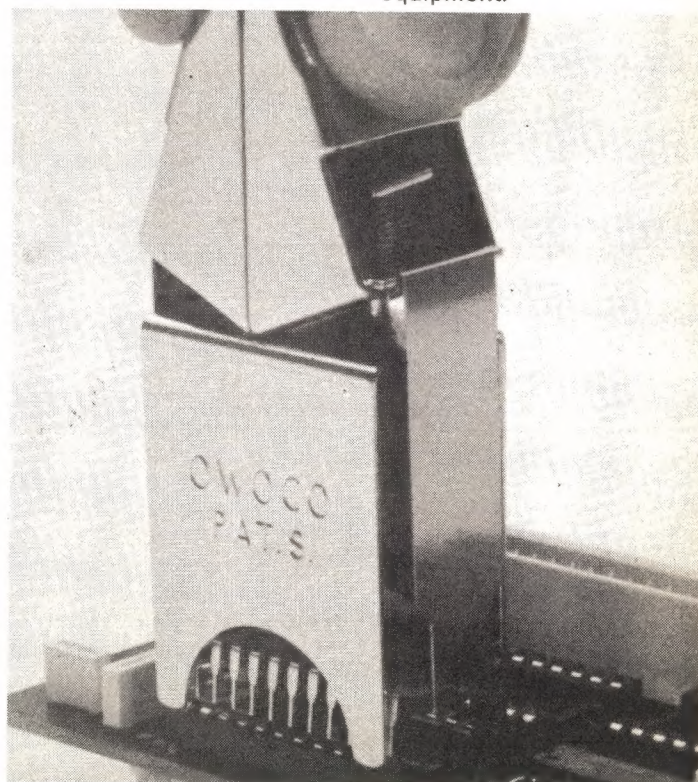
The BBC computer was chosen because of the high level of ownership in ham radio and short wave circles and the new unit is complete with software.

Many transmissions can be copied from all over the world using this system which has facility within the software to receive pictures from both 50Hz and 60Hz countries.

The rear of the hardware has a 20pin IDC connector which mates directly with the BBC computers I/O port. This cable carries all digital and power rails to and from the computer. The tape containing the program also has SSTV video pictures and test signals recorded on the reverse side. This facilitates setting up the converter as well as allowing the owner to become familiar in using the equipment.

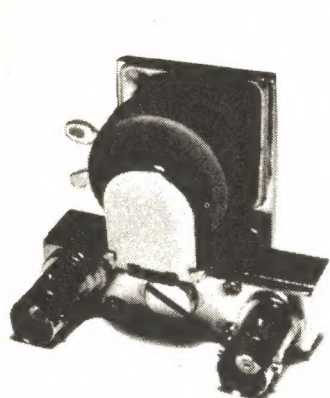
## SLOW SCAN TV

There is now a great interest in ham radio circles towards the reception of Slow Scan Television using computers and G3LIV and G8VEE have jointly designed a new add-on for the BBC computer which allows reception of ham radio video transmis-





# SPRING HAS SPRUNG!



Ambit's Spring '84 catalogue brings all the parts you need for electronics, radio, audio and computing to your front door.



There's details about an exciting new range of kits and modules being launched into the UK in conjunction with the leading German hobby supplier; full information on our two new regional sales counters in Portsmouth and Broxbourne; new low cost instruments from Black Star - plus all your old favourites:

NiCads, chargers, TOKO coils, filters, and communications ICs, crystal filters, Audio and RF semiconductors - including the biggest range of low cost varicap diodes for all types of electronic tuning.



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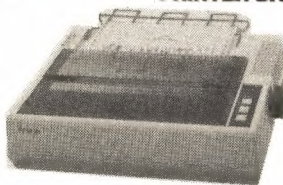
Park Lane, Broxbourne, Herts  
Burrfields Road, Portsmouth





# HART

## 'PRINTER BARGAIN'



EPSON RX80F/T. Very latest Model with Friction and Tractor feed to take plain or sprocketed paper up to 10" wide. 100 cps, 9x9 Matrix. Bi-Directional. Logic Seeking. Prints normal, Italic, condensed and double width characters, dot addressable graphics capability. Centronics parallel standard input, connects straight to the BBC 'B' and many other computers. Other printers and a wide range of interfaces for other machines is available, see our lists.

OUR PRICE ONLY £274

RX80 as above but Tractor feed only £244 Both Plus Vat. Carr £7

## SOLENOID CONTROLLED HI FI/DIGITAL CASSETTE MECHANISM



Front loading deck with full solenoid control of all functions including optional read in fast wind modes. 12 volt operation. Fitted 3-digit memory counter and Hall IC Motion Sensor. Standard erase and stereo R/P Heads. Cheapest price ever for all these features. Only £38.90 plus VAT. Full technical specification included.

## LINSLEY-HOOD 100 WATT POWER AMPLIFIER

Our complete kit for this brilliant new design is the same size as our Linsley-Hood Cassette Recorded 2. Kit includes all parts for two power amplifiers with large heatsink area, huge power supply and speaker protection circuit. Total cost of all parts is £114.46 but our special introductory price for all parts bought together is only £105.50.

### DOLBY 'B' NOISE REDUCTION IC LM1011

Marvellous opportunity for home experimenters, build your own noise reduction system. Supplied complete with circuit showing typical application. **Absolute knockout price only £3.50 for two inc. VAT and post**

### COMPLETE STEREO CASSETTE DECK

Brand new high quality top-loading Cassette Deck complete with Record/Play electronics. Supplied with connection data and circuit diagram. Automatic chrome/ferric switching. Only needs 9v DC supply. **Total price only £18.34 inc. VAT and post**

### COMPLETE STEREO TUNER MODULE

Three band LW/MW/FM Stereo Tuner fully assembled on PCB 165 x 85mm. Supplied with Ferrite rod aerial and band switch fully wired. Facility provided to drive tuning meter and stereo LED. Only needs 12v DC supply. FM sensitivity. 2.5uV. **Price only £7.99 inc. VAT and post.**

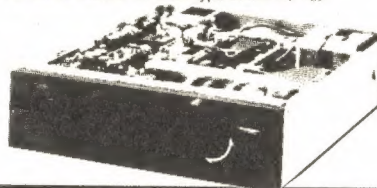
### HALF HEIGHT 5 1/4" FLOPPY DISK

Incredible Offer on latest MPU controlled 80 Track Drives, 100% compatible with BBC Micro. Support single or double density according to control chip in use. Fully compatible with Teac, Shugart and many other full and half height drives.

80 Track, Single Side £179

80 Track, Double Side £225

full works Manual for each type £14.50 No Vat.



## HIGH QUALITY REPLACEMENT CASSETTE HEADS



Do your tapes lack treble? A worn head could be the problem. Fitting one of our replacement heads could restore performance to better than new! Standard mountings make fitting easy and our TC1 Test Cassette helps you set the azimuth spot-on. We are the actual importers which means you get the benefit of lower prices for prime parts. Compare us with other suppliers and see! The following is a list of our most popular heads, all are suitable for use on Dolby machines and are ex-stock.

**HC20 Permalloy Stereo Head.** This is the standard head fitted as original equipment on most decks. £4.25

**HM90 High Beta Permalloy Head.** A hard-wearing, higher performance head with metal capability. £6.20

**HS16 Sandust Alloy Super Head.** The best head we can find. Longer life than Permalloy, higher output than Ferrite, fantastic frequency response. £3.20

**HQ551 4-Track Head** for auto-reverse or quadrophonic use. Full specification record and playback head. £7.40

Please consult our list for technical data on these and other Special Purpose Heads.

## HART TRIPLE-PURPOSE TEST CASSETTE TC1

One inexpensive test cassette enables you to set up VU level, head azimuth and tape speed. Invaluable when fitting new heads. Only £3.80 plus VAT and 50p postage.

**Tape Head De-magnetiser.** Handy size mains operated unit prevents build up of residual head magnetisation causing noise on playback. £3.68

Full details of the entire range of HART products is contained in our illustrated lists.

Ask for your FREE copy NOW.

Enquiries for lists are also welcome from overseas but please let us have three IRCs to cover the cost of surface post or 5 IRCs for airmail.

In a hurry? A telephone order with credit card number placed before 3pm will be despatched THAT DAY!

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# SPRING SALE!

## DIGITAL MULTIMETER KITS

These 3 1/2 digit handheld DMM's are fully complete with all components (except PP3 battery) and test leads. We are using up all stocks of the DP2010K prior to launch of a new range of meters. The Kits will be sold on a 'first come first served' basis, and are fully guaranteed. A trouble-shooting and calibration service will be maintained. This is a once-only opportunity to make a DMM at an incredibly low price. Supplied with a comprehensive description of operation and full constructional data. After selling over three thousand kits in the last 4 months we now have only 500 left — so hurry.

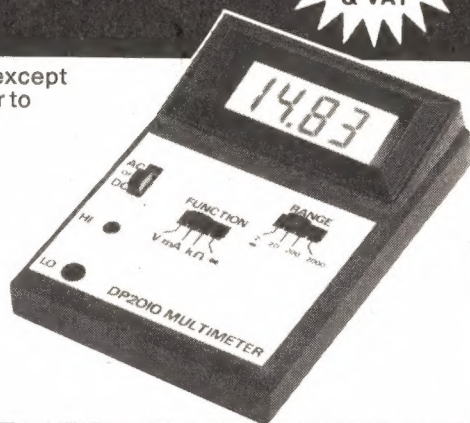
### TYPICAL SPECIFICATION

Function	PSD	Accuracy	Function	FSD	Accuracy
Volts (d.c.)	2V	1.5% ±1 digit	Current (a.c.)	2mA	2% ±5 digit
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	200V			200mA	4% ±5 digit
	500V			2000mA	12% ±5 digit
Current (d.c.)	2mA	1% ±1 digit	Resistance	2k	1% ±1 digit
	20mA	1% ±1 digit		20k	1% ±1 digit
	200mA	3% ±1 digit		200k	1% ±1 digit
	2000mA	10% ±1 digit		2000k	1% ±1 digit
Volts (a.c.)	2V	2% ±5 digit	Diode Test	2V	1% ±1 digit
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	200V				
	500V				

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## PRODUCT NEWS

Until this unit was designed SSTV was only possible with the use of very expensive scan converters costing many hundreds of pounds, or by using the old fashioned long persistence crt design.

Please send sae for information.

*John Melvin (G3LIV), 2 Sallerters Court, Gosforth, Newcastle, Tyne & Wear. Tel: 0632 843028.*

### COMPACT POWER SUPPLIES

A new range of modular mains switching power supplies from Gresham Powerdyne Ltd are available in output levels up to 500W, but are unusually compact and extremely efficient for their size. The range includes multiple output types. They employ direct-off-line switching techniques to reduce physical dimensions to a minimum and keep efficiencies around 70%. At each of the output power levels, 50, 100, 200, 300 and 500W, the units are available with various combinations of output voltage (5, 12, 15, 24V) and equivalent maximum current ratings.

The two triple output versions provide a principal 5V rail (either 20 or 60 amps), with two further secondary outputs of either 12 or 15V. Units are tested to 2.5kV isolation between input and output and comply with both BS800 and VDE0875. Output voltages are adjustable to  $\pm 5\%$  of nominal by means of screwdriver adjustments on the front panel. Facilities are also provided for local or remote sensing and for voltage programming by means of an externally connected resistor. All units are provided with constant current protection against overloads or short circuits, also with overvoltage protection by means of automatic control circuit shut-down. For single output models, voltage regulation is better than 0.1% for a worst case combination of 0-100% load change and a  $\pm 10\%$  line change within the rated input voltage. Ripple and noise is better than 10mV rms in all cases and operating temperature coefficient is less than 0.01%/°C. Over voltage protection is standard on all units.

*Gresham Powerdyne Ltd. Tel: (025672) 4246/7/8.*

### OPTICAL ENCODERS

Litton Precision Products has introduced a new family of rotary shaft optical encoders, the G61S and G61M family, which features a frequency range of 0 to 100kHz, a long life LED light source, supply voltage requirements of 5V and 8-15V and operating temperature range of 0 to 70°C.

With optional radial or axial cable output, these devices can easily be fitted to a shaft in place of an existing potentiometer to give a digital instead of an analogue output signal. Variants within the range include the TL (TTL - compatible) OC (open collector), PP (push-pull), PS (push-pull with short circuit

protection) and LD (line driver). The G61 series is a family of low-cost encoders with up to 1024 lines.

Applications include digital control motors in computer peripherals such as printers, control of tensile testing machines and cut-to-length machines.

G61M models are supplied as a 'kit' for OEM applications. However, Litton offer a fitting service and will fit these encoders on to customers' shafts for them.

The G61S models are supplied complete with housing.

A hand-operated dial with mechanical indent is an option available for both models and has been designed specifically for applications

where operator hand control of, say, CNC machines is required.

An additional feature of these encoders is that two output channels are provided so that both clockwise and anti-clockwise direction of rotation can be sensed.

*Litton Precision Products International Inc, 95 High Street, Slough, Berks. SL1 1DH. Tel: 0753 77788.*

### SOCKETS & TERMINAL STRIPS

Robinson Nugent Ltd, announces a new range of strip sockets and mating terminal strips. Known as the SBQ series, the sockets are for .025in square terminals, feature beryllium copper contacts and are ideal for mother-/daughter module connectors.

The WTS .025in square terminal strips are for use with the new SBQ sockets. Standard size is 36-pin with notching to break for desired size. Mounting is straight or right angle.

*Robinson Nugent Ltd, 74 London Road, Riverhead, Sevenoaks, Kent. Tel: (0732) 460033.*

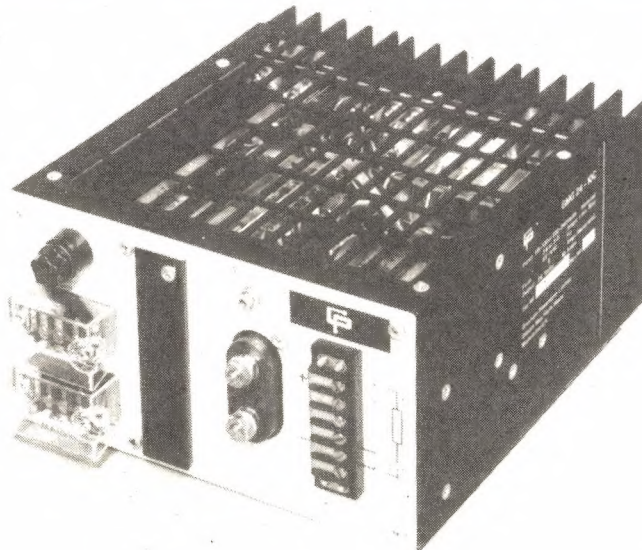
### INSTRUMENT KNOBS

The Mentor range of top-quality instrument knobs, supplied by West Hyde, has now been extended to include three new products.

The first is a series of plastic collet knobs, featuring a raised, knurled band to ensure a slip-free grip and is available in black or grey in seven sizes from 10 to 50mm diameter. Collet knobs are now available with a black anodised finish in addition to the original silver version. They are machined from aluminium alloy and are suitable for use under the most arduous conditions. Both colours are available in seven sizes from 9 to 36mm diameter. These can be fitted with caps, dials, pointers and other accessories from the existing wide range.

Where a variety of accessories is unnecessary, an 'Economy Series' knob is available at low cost in a matt, textured black or grey finish.

Four sizes from 12 to 28mm diameter can be supplied, with or without a nut cover. Caps in three colours with an



### LOW NOISE GaAs FET

The Mitsubishi MGF 1404 is a super-low noise GaAs FET with a N-channel Schottky gate which is designed for use in S to Ku band amplifiers. Its hermetically-sealed metal-ceramic package assures minimum parasitic losses and has a configuration suitable for microstrip circuits.

Features include typical high maximum frequency of oscillation of 90 GHz, noise figure of 1.6dB at 12GHz, and a gain of 10.5dB at 12GHz.

*Aspen Electronics Limited, 2 Kildare Close, Eastcote, Ruislip, Middlesex HA4 9UR. Tel: 01-868 1188.*

### MINIATURE VCO'S

New ADE products from Nore Microwave include four voltage-controlled oscillators which cover the frequency range 0.1 to 1.6 GHz

and have individual bandwidths of 0.1-0.2, 0.2-0.4, 0.4-0.9 and 0.9-1.6GHz.

Featuring low noise and highly stable operation with good linearity, each of the units has an output power of +10 dBm x dB (in 50ohms), the fm noise (@50KHz) is -70dBc, harmonics - 15dBc and its control voltage range is 0 to +10 volts. The frequency drift related to variations in supply voltage, temperature and VSWR is 1MHz/V, 150KHz/°C and 1MHz (VSWR 2:1). The units operate with power supplies of +15 V and are ideal for use in applications where space is restricted, the overall case dimensions (in millimetres) of each device being only 24.5 x 12.5 x 9.0 (excluding terminations).

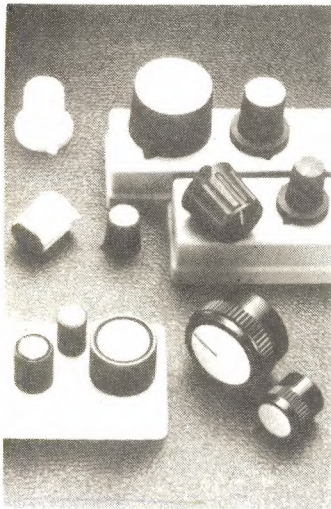
*Nore Microwave Limited, 56 Towerfield Road, Shoeburyness, Essex. SS3 9SH.*



## PRODUCT NEWS

optional indicator line are also available to fit these knobs.

Knobs can be chosen to suit a wide variety of spindle sizes and feature a precision brass collet which ensures the maximum grip on the spindle.



West Hyde Developments Ltd, Unit 9, Park Street Industrial Estate, Aylesbury, Bucks. HP20 1ET. Tel: Aylesbury (0296) 20441.

### WEIR SMM 100S POWER SUPPLIES

The Weir Electronics SMM 100S switched-mode power supply units are the latest in the SMM series to receive British Telecom approval to TG2 and TG26 specifications. This approval allows the use of these oem units in equipment which is connected to BT voice or data networks.

SMM 100S series are compact, high-efficiency, switched-mode power supply units, capable of delivering up to 100 W continuous power output. They are multi-rail units with output voltages particularly suitable for micro-computers, intelligent terminals, disc drives, tape-cartridge units, modems and other equipment employing TTL and CMOS technology.

This type of equipment is frequently connected directly or indirectly to BT lines, so that power supply approval is an important factor. SMM 100S power supplies are also designed to meet all relevant BS, IEC, VDE and ECMA safety requirements.

Basic models of the range combine a 5V, 10-amp main output with 12V 3-amp and 12V 1-amp outputs and a 5V 1-amp negative bias rail. The 12V 3-amp output can provide surge

currents up to 5 amps for DC motor starting. Five-output variants of these models include either an additional 12V or 24V output with peak current capability up to 2 amps.

WEIR ELECTRONICS LTD,  
Durban Road, BOGNOR  
REGIS, Sussex, PO22 9RW.  
Tel: (0243) 865991.

### EUROCARD DC/DC CONVERTER

For systems designers the versatility of a plug-in DC/DC converter for standard Eurorack offers ease and simplicity of use. Available from Powerline the SW range of single output PWM switchmode converters is manufactured in Europe by Fabrimex.

The range includes 9 models with output powers of between 25W and 96W with guaranteed minimum efficiencies of 65% to 85% depending on model. Five output voltages of 5V, 12V, 15V, 24V and 48V are available with currents of between 12A for the 5V output and 2A for the 48V output.

With a wide input voltage range of 20V to 60V these units are suitable for many applications. No additional cooling or derating is required across the operating temperature range of 0-50°C.

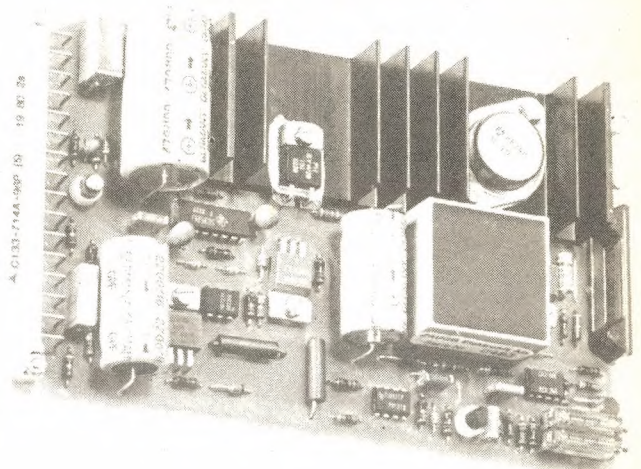
All models feature short circuit and overvoltage protection, together with input/output isolation of 500V. TTL-compatible inhibit is standard and all outputs are adjustable by  $\pm 10\%$ .

The units are standard Eurocard size of 160mm by 100mm with two heights of either 24mm or 60mm.

Powerline Electronics Ltd, 5 Nimrod Way, Elgar Road, Reading, RG2 0EB. Tel: Reading (0734) 868567/9.

### A PRECISION ENGINEERED KEY

The Alpha Key is designed and engineered for the operator who wants only the best. Each is made and finished to a high standard. Two types are available - cast aluminium or cast iron. Both with a large base area for stability. The paddle is pivoted on ball bearings for a very smooth movement and when adjusted correctly there is no vertical movement. Both sets of contact points are silvered for good



electrical contact and long life.

For the return pulling power, polymer-bonded rear earth magnets are used. These offer a high power and good properties against demagnetization.

The Alpha Key has a very stable design that does not alter with temperature. The aluminium base is finished in black and a personalised base can be supplied with your own call sign on it. The cast iron base is a heavy base finished in black or chrome.

P Sergeant (G4 ONF), 6 Gurney Close, Costessey, Norwich, NR5 0HB. Tel: (0603) 747782.

### G2DYM SUPER-Q TRAPS

G2DYM SUPER-Q TRAPS are actually parallel coil-condenser combinations designed to resonate in the various Amateur bands. The condensers are 16kV ceramics completely epoxy-potted against moisture. Traps are wound with 1.5mm lacquered copper wire on threaded formers. Ratio of length to diameter plus low loss material results in Super-

Q Traps. Because of the high Q and impedance at resonance the traps act as effective insulators in the band in which they are resonant.

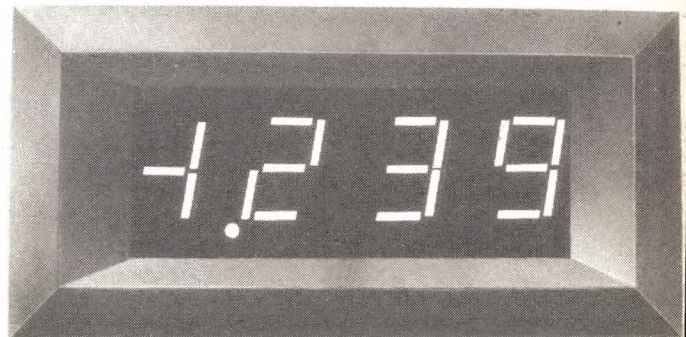
By adding three additional sets of traps resonant at 10-15 and 20 metres, it is possible to have a perfect dipole on each band. It is not necessary of course to use four sets of traps. For example, if you do not care to operate 10 metres, the DYM-10 traps may be left out and the centre section cut for 15 metres.

Another example: if operation on 80 is not required, insulators may be used in place of the DYM-40 traps, in which case the aerial will provide dipoles for 10-15-20 and 40 metres.

G2DYM Aerials, 'Cobharnden Castle', Upplowman, Nr Tiverton, Devon.

### LED DPM

A recently introduced LED DPM is claimed by its manufacturers to be the smallest available DPM with standard 11mm high efficiency digits. Auto-polarity, Auto-zero, 200mV fsd programmable





## PRODUCT NEWS

decimal points, polarised filter and a single 5V supply are all standard features. The meter can be used in single-ended, differential or 'floating' modes, and can be easily adjusted by the user to read volts, amps or other units.

The compact size and low-cost of the DPM40 makes it very suitable for high volume OEM applications such as bench power supplies and battery chargers.

*Lascar Electronics Limited, Module House, Whiteparish, Salisbury, Wiltshire, SP5 2SJ. Tel: Whiteparish (07948)567*

### INTERFACE FOR ZX81 AND SPECTRUM

Velleman are pleased to announce the introduction of their interface system consisting of a specific motherboard for each type of computer and interface cards that can be plugged onto the motherboards.

In this way, it is possible to add to each system the following features: K2609: eight (8) open collector outputs (25V/50mA), K2610: A/D conversion, 8 bit precision, 5.1V full scale, K2611: eight (8) optocoupler inputs, K2614: Centronics parallel printer interface, K2618: D/A conversion, 8 bit precision 1.02V full scale. Several other cards are also being developed.

The motherboards for the ZX81 and the ZX Spectrum are now available, both offering space for for interface cards. They are provided with a 23

pole edge connector at the back, giving the facility to connect the ZX printer or to stack more motherboards one after the other.

Power is taken from the computers' 9V DC supply or from an external unregulated 9-12V DC power supply, depending on the consumption and the number of interface cards that are used.

*Velleman (UK) Limited, P O Box 30, St. Leonards on Sea, East Sussex. TN37 7NL.*

*Tel: 0424 753246.*

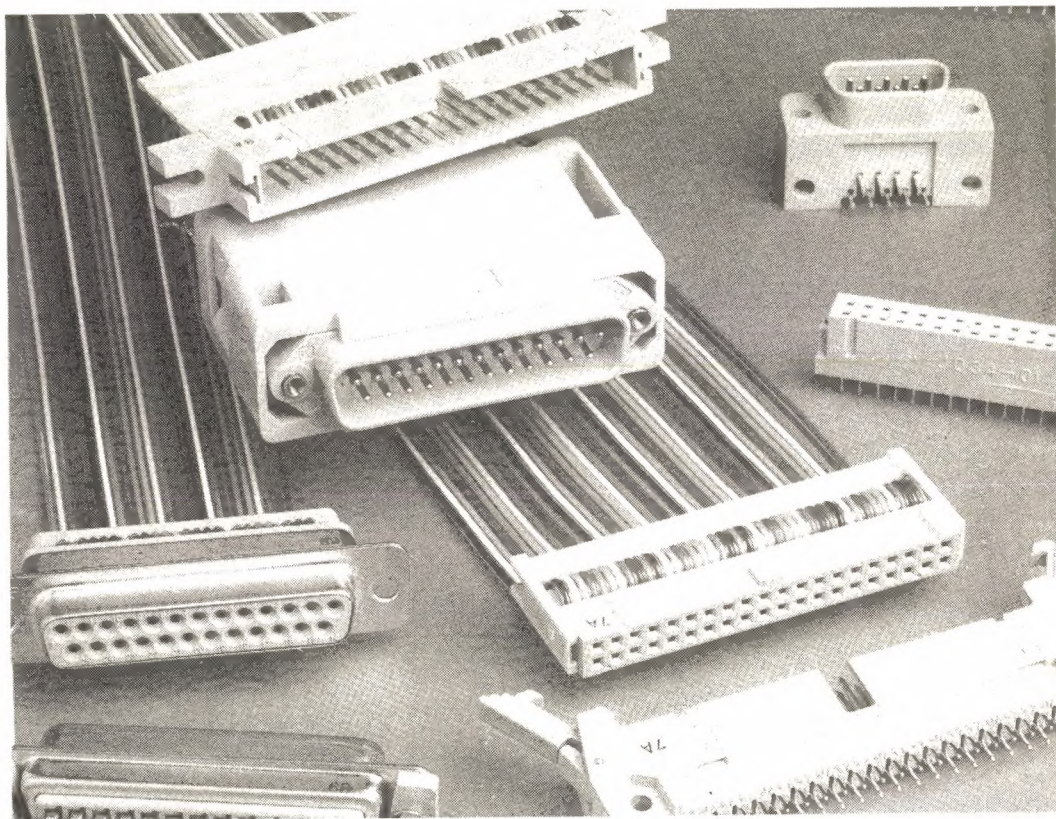
### INTERCONNECTION SYSTEM

A full colour, 20-page catalogue is now available from BICC - Vero Electronics Ltd detailing their M50 flat cable interconnection system.

The catalogue provides full details on the fifteen connector types which go together to make the comprehensive M50 system, plus information on application tooling and data on both M50 and M50E flat cable.

Connector types within the range include sockets; fully shrouded, unshrouded and low profile headers; 'D' sub-miniature connectors; crimp sockets; transition connectors; DIP connectors; pcb-mounted plugs and associated sockets; plus card edge connectors.

*BICC-Vero Electronics Ltd., Hedge End Industrial Estate, Flanders Road, Hedge End, Southampton, SO3 3LG Tel: (04892) 81424/5.*





# We don't sell our sets until we know them inside

## The new IC-02E Push-button Perfection



ICOM introduces the new top-of-the-line IC-02E to compliment its existing line of popular handheld transceivers and accessories. The new direct entry microprocessor controlled IC-02E is a 2 meter handheld jam packed with excellent features.

Some of these features include: scanning, 10 memories, duplex offset storage in memory & odd offsets also stored in memory. Internal Lithium battery backup and repeater tone are of course included.

Keyboard entry is made through the 16 button pad allowing easy access to frequencies, duplex, memories, memory scan and priority. The IC-02E has an easy to read custom LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions.

A battery lock, frequency lock and lamp on/off switch are also featured, as is an aluminium case-back, providing superior heat sinking.

A variety of batteries will be available for the IC-02E, including new long-life 8.4 volt and 13.2 volt packs. Top panel connector for 13.8 volts which will power transceiver operation.

The IC-02E continues to be available, and its complete range of accessories work with the new IC-02E.

The IC-02E comes with the BP3 Nicad battery pack, BC25E wall charger, flexible antenna, wrist strap and belt clip as standard equipment. A truly excellent product destined to a great future.

We do not sell any sets until we know them inside out. A bold claim, but true. Our engineers have been trained by ICOM in Japan, and can guarantee the best after-sales maintenance service available.

As well as the 02E, 751, 745, 271, 471, R70, 290D, 490E, 25H, 45E, 2KL, AT100, AT500, 120, 2E, 4E in the ICOM range we also stock such famous names as Tono, Telereader, Cue Dee, Versatower, Yaesu, Jaybeam, Datong, Welz, G-Whip, Western TAL, Bearcat and RSGB Publications. Thanet Electronics can offer you the most comprehensive and thorough service.

**Thanet ICOM** **Thanet ICOM** **Thanet ICOM** **Thanet ICOM** **Thanet ICOM** **Thanet ICOM** **Thanet ICOM**



The IC745 is another superlative set in the ICOM range, see it in our retail shop at 95 Mortimer Street, Herne Bay Kent, or contact our Reculver Road address for more information. Your own local ICOM dealer will be able to help you too.

The price has not yet been announced but give us a call for this and other information.

Gordon G3LEQ Tel: Knutsford (0565) 4040

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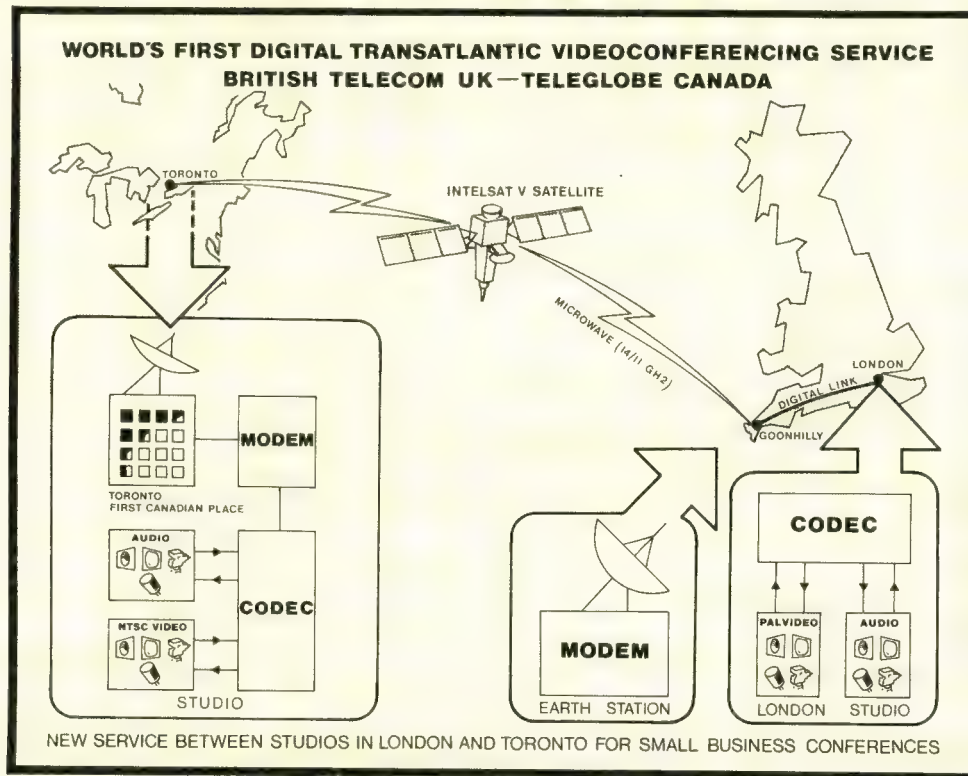
143 Reculver Road, Herne  
Tel: (02273) 63859/6385

**BARCLAYCARD**  
**VISA**

  
See it with Xerox



# NEWS



## First of its kind

A new generation of small dish aerials, with an improved performance that will enable more countries to use satellites for communications, has been successfully developed and brought into operation by British Telecom International

(BTI). It is the first of its kind in the world to go into commercial service.

It will soon be used to launch the world's first satellite based end-to-end digital transmission service across the Atlantic. To be called SatStream North America,

this service is now being set up by BTI and Teleglobe Canada.

The new aerial was developed jointly by BTI and British Telecom's research laboratories at Martlesham Heath, near Ipswich.

It has a 5.5m (18ft) diameter

dish and is known as an offset Gregorian antenna.

The first has been installed on the roof of a Telecom building in Ealing, West London.

It will work to an Atlantic Ocean Intelsat V Satellite.

## Plessey reorganisation

As part of a programme of major investment and the reorganisation of its manufacturing facilities for telephone exchange and related equipment, Plessey Telecommunications Limited has announced a rationalisation programme at five of its plants in the North of England.

At three factories, programmes to accelerate System X and to progressively introduce other new product ranges will take place. These sites are at Edge Lane, Liverpool; Chorley, Lancashire; and Huyton, Merseyside.

At South Shields, where some 600 people are employed, the manufacture of exchange equipment will cease by the end of August 1984. Plessey Circuits Limited, employing 290 people and producing printed circuit boards on the same site, will not be affected.

Plessey's Lamberhead, Wigan factory where 240 people are employed will close by May, 1984.

## The GIOTTO spacecraft

Further to all the information given about GIOTTO in last month's News columns of *R & EW* we now publish the following details from British Aerospace Dynamics Group:

### The Mission

GIOTTO is to be launched by an Ariane 1 from Kourou, French Guyana in the summer of 1985, to intercept Halley's Comet in March 1986, following an 8-month flight. Launch will take place in July 1985. Suitable conditions for the launch exist for 20 minutes or more every day during this period.

Following launch, GIOTTO will be released into an Earth geosynchronous transfer orbit. After a few revolutions in

this orbit, when near perigee, GIOTTO's solid-propellant motor will be ignited and the spacecraft will be propelled into a heliocentre trajectory towards Halley's Comet.

Interception will occur during the night of March 13/14, 1986, about one month after the comet's closest approach to the Sun. GIOTTO is being targeted to pass through the cometary atmosphere (coma) of Halley's Comet within 500km (310 miles) of its nucleus, on the sunward side. Allowing for orbital errors, GIOTTO is expected to penetrate within at least 2000km (1250 miles) of the nucleus.

During the critical final four-hour encounter, phase data will be relayed back to Earth in real time from the experiments carried on board GIOTTO. Completion of the mission occurs 15 minutes after GIOTTO has passed its closest point to the comet.

Ten experiments constitute the scientific payload of GIOTTO.

One of the sensors is a multicolour camera, which will obtain images of the comet's nucleus and the surrounding coma.

The other experiments are concerned with an examination of coma chemistry; analysis and the dynamics of the cometary plasma, and its interaction with the solar wind; and an investigation of mass, distribution and composition of the dust cloud associated with the comet.

GIOTTO will be controlled from the European Space Agency's Operations Centre at Darmstadt, West Germany. Experimental data relayed by GIOTTO during its encounter with Halley's Comet will be received via the 64m dish antenna of the Parkes Radio Telescope in Australia.



# NEWS

## Spacecraft Data

Height almost 3m; Diameter 1.84m; Spin stabilised 15 rpm; Orbit prograde-in same direction as Earth's Satellite fly-by velocity 68 kilometres per second; Data transmission - microwave in X and S bands; Transmitter power 20 watts; Antenna (on-board) 1.5 metre parabolic; Experiments 10; Experiments mass 56 kilograms; Launch - Ariane July 1985; Encounter - March 1986.

Command, control and data signals pass between Giotto and Earth via high gain dish antenna with an effective diameter of 1.47m. The antenna is despun and canted at an angle of 44.2° to Giotto's spin axis to maintain its line-of-sight to Earth during the comet encounter phase. The feed horns are carried on a tripod structure straddling the antenna. Signals will be relayed in either S-band (2.1GHz uplink, 2.3GHz downlink) or X-band (8.4GHz downlink). Antenna pointing accuracy is critical, especially for X-band transmissions (a 3dB loss occurs for 0.8 error in X-band).

## In search of the space shuttle

The March 1984 issue of *73: Amateur Radio's Technical Journal* is devoted to coverage of the historic ninth mission of the Space Shuttle, in which an astronaut/ham radio operator received NASA's permission to operate from space for the first time.

Dr Owen Garriott (callsign W5LFL), on his second shuttle mission, verified ham radio's effectiveness in acting as the ultimate in backup communications systems. On prior missions, the aerospace administration feared that such communications would interfere with the electronics of the spacecraft, and with the astronaut's primary responsibilities. Garriott succeeded in laying those fears to rest and, in post-mission remarks at the Johnson Space Center in Houston, remarked, 'We accomplished everything we set out to do'.

73's 'In Search of the Shuttle: A Ham in Space,' recounts the efforts of twenty-one American ham operators, located from Maine to Hawaii,

who were specially recruited by the magazine on the basis of geographic location to communicate with the shuttle during its mission. The geographically distributed network of operator/reporters, the first such network ever established by an amateur radio journal, was the brainchild of 73's executive editor, Jack Burnett. The project was the most expensive editorial undertaking in the magazine's history.

Both NASA and the ARRL (American Radio Relay League) cooperated in supplying information to Burnett. Since Garriott was only permitted to operate in his spare time, and since the orbital patterns of the shuttle would take it over different areas of the country at different times, the co-operation of NASA and the ARRL was crucial to the success of the project.

Garriott estimates that of the more than 100,000 operators who attempted to make contact, he heard three-hundred operators. Due to the tenacity of the operators' combined efforts and the organisational skills of the 73 staff, it is believed that several 73 reporters succeeded in getting through. Verification will be made after Garriott completes a review of the tape recordings he made onboard which document the contacts.

## Robotics conference 1984

The 1984 ACC Micro-robotics Conference is to be held at Central Hall, Westminster, on 21 April. The venue is in conjunction with the Association of London Computer Clubs' Easter Fair, and many of the stands will have a Robotics flavour.

Subjects planned for the Conference range from hobby interests to commercial applications, with talks and demonstrations by representatives of some of the leading manufacturers. The Micromouse maze will be featured, and a 'friendly' competition has been arranged. Novice constructors are encouraged to see how their mice perform against the old hands. The Robot Arena will also be there, with demonstrations and advice for home constructors.

## Circuit technology conference

LeaRonal (UK) plc will be displaying a comprehensive range of their latest processes and services specially designed for the PCB industry at the forthcoming Circuit Technology Conference to be held at the Kensington Exhibition Centre in London from the 3rd to 5th April 1984.

There are six items that will be of specific interest to Printed Circuit Board manufacturers. These are:- Copper Gleam 125, the new high speed acid copper plating solution; Ronovel N, the latest gold process from LeaRonal with British Telecom M468A approval; Pallamet 30 palladium-nickel process deposit meets the requirements of British Telecom M468A specifications when used in conjunction with a gold flash deposit (0.25 microns); Ronascreen resists and soldermasks, a new range of plating resists, etch resists, soldermasks and legend inks. They are available as thermal cure and UV cure products; the Solderon NF non-fluoborate tin-lead process which provides improved metal distribution, higher current density operating 'window' for given metal concentration and is a more stable alloy over wide current density range.

## Ships at sea and information technology

Ships' crews and passengers can now plug into the world of information technology.

Ships which use British Telecom International's maritime satellite system (Inmarsat), can access a wide range of computers and databases round the world

through BTI's international packet switching service, IPSS.

The new service will provide packet-switched links to the UK's public data network, Packet SwitchStream (PSS), and also to more than 50 similar data networks in over 30 countries. It will enable shipboard users to call up data on a wide range of marine-related subjects, including meteorology, geostrophysics, oceanography, naval records, marine pollution and its control, ports and harbours, seaways and ocean mining.

For computer users, packet switching has several important features: It makes national and international data communications simpler to set up, quicker to connect and more reliable in operation. It provides a flexible and reliable way of linking different computers and terminals and enables terminals working at different speeds to communicate with each other. It automatically re-routes packets along different paths to avoid congestion or route failure.

Shipboard customers will be able to use synchronous character terminals generating data at 300 bit/s. They will connect to IPSS by dialling the London IPSS exchange. Ships in the Atlantic ocean would use BTI's earth station at Goonhilly Downs, Cornwall.

Once connection has been established to the IPSS gateway, the user gives his IPSS 'password' (network user identity) and then the 'address' of the computer to be called.

To gain access to particular databases, users will also need to make the necessary commercial arrangements with their proprietors.

# Company News

## Ambit move

Ambit International, the electronics components supplier to industry and the home electronics market, is to move its headquarters from Brentwood to Broxbourne in Hertfordshire, though it will retain a sales counter in the Essex town.

The move is being made, to

enable the company to maintain the present pattern of growth. Demand for Ambit's services has risen steadily to the point where the Brentwood premises can no longer provide the necessary facilities.

Ambit's new address will be *Ambit International, Park Lane, Broxbourne, Herts.*



# NEWS

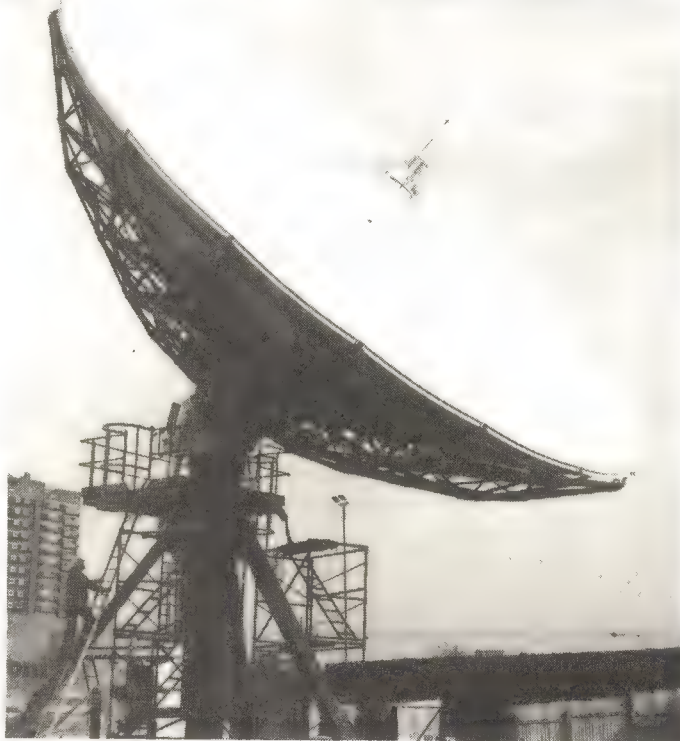
EN10 7NQ, the headquarters of its parent company, Cirkitt Holdings PLC and sister company, Broxlea Limited.

## Marconi changes dockland skyline

Engineers from Marconi Communication Systems Ltd, Chelmsford, are working on two projects that will bring the space age to London's dockland. Two separate sites, one on The Isle of Dogs and the other at Woolwich will be nearing the first stages of completion.

On the Isle of Dogs, Marconi is supplying Mercury Communications Ltd with two complete satellite earth stations that will be used to provide international links for leased-line and other switched services. A 13-metre dish will provide service to North America via the INTELSAT V satellite and an 8-metre station will provide services to Europe.

At Woolwich, Marconi is



The new London 1 Satellite Earth Station at Woolwich

supplying British Telecom International (BTI) with three 13-metre antennas which will also provide services via INTELSAT V and through the ECS satellite. The system is designed so that, by the substitution of a few components, either terminal may assume the role of one of the others.

Both projects are well in hand. At Woolwich, the first antenna and the container housing the ground communication equipment are in position and work has already started on the second antenna.

A fully duplicated system of ground control equipment is being supplied to both sites.

In addition to the London sites, Marconi has also received from Mercury Communications an order for the supply of a complete earth station for the first terminal to be built at a site near Kidlington, Oxfordshire.



## The magnificent TIGER LY9 antenna

### New from Ant Products

New from Ant Products a superb addition to the range of renowned antennas, the Tiger LY9 for 70cms. A lightweight beam antenna with a heavyweight signal. Offering a high 11dB gain on a 58 inch boom length. Great for vertical or horizontal mounting. Supplied in matched pairs for the ultimate Oscar Station complete with all hardware for mounting with elevation control. Precisely adjustable for angle in order to get the best performance. Also including matching unit for circular polarisation. Right or left hand can be chosen with equal efficiency. Last but not least our famous two year guarantee and full back-up service.

Write now for full details enclosing S.A.E. + 25p in stamps.

**Single Antenna £15.95**  
**Complete Oscar Kit £39.95**

**Ant Products**

All Saints Industrial Estate  
Baghill Lane, Pontefract, West Yorks.  
Telephone Pontefract (0977) 700949

Amateur, Marine, C.B., Aircraft  
and Commercial Aerials supplied

PHILIPS P2000 DAISY WHEEL PRINTER RS232 £375 ea  
SHUGART 801 FLOPPY DISK DRIVES 8" £100 ea  
TRANSTEL DOT MATRIX PRINTER. Compact £35 ea  
Serial Interface 230V With Info. £50 ea  
TELETYPE ASR33 (Printer, Keyboard, Punch and Reader) RS232 £50 ea  
9" MONITOR Cased Non-Standard. With info £20 ea  
12" MONITOR Cased Non-Standard With Info £15 ea  
AZTEC 20" Black & White MONITOR Video in £50 ea  
TV Style 20" MONITOR Black & White Video in £30 ea  
GENERAL ELECTRIC TERMINET Printer with Keyboard Upper/Lower case £125 ea  
ICL Version of above. No Keyboard £95 ea  
QWERTY KEYBOARD. Push to make. Un-cased £15 ea  
P&P £4  
CARRIAGE ALL UNITS £7.

**STEPPING MOTORS**  
Type 1. 200 Steps 4 Phase (5 wire) 12/24V 25oz inch. 2 1/4" dia. £15 ea  
Type 2. 8/12 Steps 3 Phase 12/24V. 1 1/4" dia £2 ea 5 for £7.50  
Type 3. 24 Steps 4 wire 5V 3.3A 0-2500rpm 0-200PPs 2 3/4" dia. £10 ea  
Type 4. 200 Steps 120V (3 wire) 25 oz inch. 2 3/8" dia. £4 ea  
**MOTORS**  
SYNCHRONOUS 2 Phase 9V AC. 375rpm Cap start Will DC step. — 8 steps per rev. £1 ea  
GEARED 117/234V 50HZ. 4" dia £5 ea P&P £2  
GEARED 115/230V 1 rpm 2 3/4" dia £4 ea P&P £2  
MOTOR 12V DC 3" dia £3.50 ea. P&P £3

**TRANSFORMERS**  
TOROIDAL 13.5-0-13.5V 8VA — £1.50 ea 10 off £12  
TOROIDAL 0-12V: 0-12V 10VA per winding £4 ea  
10 off £35 P&P £2  
AUTO 240V Input 115V 1A £1.25 ea  
Sub-Min 12-0-12V 4VA — 75p ea. 10 off £6 P&P £2  
Printed Circuit Mounting 120/240V. Input Sec 15V 0.4A twice £1.50 ea  
Chassis Mounting 120/240V.  
9V 0.33A twice — £1.50 ea; 20V 0.15A twice £1.50 ea;  
5V 0.5A twice — £1.50 ea; 12V 0.96A twice £1.50 ea;  
7.5V 0.34A twice £3 ea  
Sub-Min PULSE TRANSFORMER Centre tapped. Suitable Thyristor triggering — 20p ea. 10 off £1.80  
Many other transformer available — please enquire.

**CAPACITORS**  
Electrolytic 15,000mfd 25V — 20p ea. 10 off £1.80  
Sprague Compulytic 18,000mfd 10V Screw terminal £1 ea  
Electrolytic 900mfd 100V Screw terminal 50p ea. 10 off £4

**OSCILLOSCOPES**  
COSSOR CDU150 Dual Trace 35MHZ Delay Sweep £200  
SE LABS SM111 Dual Trace 20MHZ £200  
TEKTRONIX 585A with 82 Plug-in Dual trace 85MHZ £200  
Dual TB Delay Sweep £200  
TEKTRONIX 545B with CA Plug-in 24MHZ Dual Trace Dual TB £160  
SOLARTRON CD1400 Dual Beam 15MHZ £90  
Ex-Ministry CT438 Dual Beam 6MHZ £30  
ADVANCE Dual Stab DC Power Supply PP3 0-30V. 0-1A twice. Metered. £50  
FARNELL Stab Power Supply TSV30/SEC 30V/5A £60  
AVO TRANSISTOR TESTER TT169. With leads £20  
P&P £2  
CARRIAGE ALL UNITS £7.

Tantalum Bead 0.1mfd 35V. 10 off £1. 100 off £7.50  
De-Coupling — 0.4725V; 0.005 100V; 0.47 12V; 0.001 200V; 33pF. 10 off 30p. 100 off £2

**SWITCHES**  
ILLUMINATED ROCKER 2 pole 250V 8A. Orange-50p ea. 10 off £4  
ROCKER 2 pole c/o — 12p each. 10 off £1.80  
TOGGLE Centre off DPDT — 20p each 10 of £1.80  
SLOTTED OPTO SWITCH with data-50p each 10 off £4  
Min MICROSWITCH V3-Button — 30p. 10 off £2.50  
I.C. SOCKETS 10 pin-10p; 22pin-15p; 14pin-8p 100 off £5  
36pin-15p; 40pin-25p; 16pin-8p 100 off £5  
RIBBON CABLE 10 way — 50p per metre. 10 metres £4  
14 way — 75p per metre 10 metres £5  
PCB KEYBOARD PAD 19 Push Contacts. 0-9: A-F plus 3 optional — £1.50 ea. 10 off £12  
KEYBOARD PAD 12 Alma Reed Switches Push to make 0-9: & Blank — £4 ea. 5 off £15 P&P £3  
TOKIN NOISE FILTER VG215FU. 250VAC 15A 50/60 HZ With fixing bracket. £2 ea  
BLACK RIBBONS for Teletypes/Teleprinters 75p ea 6 off £4  
I.T.T. LOUDSPEAKER 2 1/4". 50ohm 0.2W-75pa 10 off £6.50  
FERRANTI PHOTOCELL type MS15-50p ea 10 off £4

VU METER Scaled 0-5. Size 1 1/2 x 7/8 — 50p ea. 10 off £4  
I.E.C. MAINS LEAD 2 metre Heavy duty-60p ea 10 off £5  
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# HATELY ANTENNA TECHNOLOGY

GM3HAT



GM3HAT/A

## DIPOLE OF DELIGHT

The DIPOLE of DELIGHT is the familiar name for the new type of antenna with a really effective balance to unbalance (BALUN) feed system recently invented by GM3HAT and now being patented in the major industrial countries.

This antenna has created a lot of interest in amateur and professional circles because practical trials of early production models verify the expected advantages this outstanding antenna possesses attributable to its:-

1. built-in lightweight capacitive BALUN card.
2. ability to achieve multi-resonant behaviour when constructed with multiple wires.
3. rugged behaviour and 800W transmit capability due to there being NO TRAPS.
4. wide bandwidth so that NO ANTENNA TUNER is required.
5. exceptional rejection of local interference such as machine hash, TV timebase noise, and computer pulses.

### VERSIONS AVAILABLE

There are presently available seven versions made for the international amateur HF bands, and more will follow. The models are designated by a code which indicates the frequency band (or bands) of operation, defined as being the band across which the antenna has less than SWR of 1.5 to 1. The length of the DD is a full space half-wave at the lowest frequency of operation, and the antenna is fully protected against the weather including a drip-protected SO239 socket (UHF) for connection of the 50 ohm coax required. Due to variability of site length etc, coax is not supplied, but the 5mm types such as URM 76 or 43 are recommended. Larger 10mm cables (such as URM67 and RG8U) can be supported if the antenna is used as an inverted V, or if held by reduced tension. Each antenna is supplied with a helpful USER'S INSTRUCTION SHEET describing the best way to support a DD in any open or cluttered situation, as well as giving hints on how to make a low cost and inconspicuous fixed YAGI with gain at high angles for one hop paths, and how to use an ATU to make the DD work on lower amateur frequencies as a 'T' against Earth.

### ECONOMIC AND OPERATIONAL ADVANTAGE

As there is no ATU needed, a DD is an ideal first antenna. The DD is superb for amateurs who have, or intend getting, a modern semi-conductor 'NO-TUNE' PA or Linear. To change bands, flick the switch, listen on frequency and speak. Great in a contest. The wide bandwidths allow the user to make contacts away from the over-crowded central frequencies to which trap and coil-resonated antennas are tuned.

In regard to TVI the particular circumstances determine the outcome. The DD is so efficient that it will produce amateur field strengths greater than a traditional dipole. But by virtue of its excellent balance, a horizontally slung DD will produce considerable less vertical induction field (which links to TV downleads) than would an old style coax fed dipole with its unbalance current flowing down the outside of the screen. A DD has a genuine RF Earth point at its centre. Further details on SWR values and specimen input impedance plots on SMITH CHARTS may be obtained for the asking (send SAE or IRC please).

### AVAILABLE VERSIONS AND PRICES

The UK Price includes Packing Post and VAT (on 15% at time of drafting).

The DX Price includes Packing Air Mail Post, and currency exchange. Cheque may be written in ANY CURRENCY, equivalent on the day of signature to the amount in £ Sterling at published middle rate.

### SPECIFY CAREFULLY VERSION REQUIRED

	UK	DX
DD 7/14/21 length 21m (69ft)	£56.46	£56.00
DD 10/18/24 length 15m (50ft)	£56.46	£56.00
DD 14/21/28L length 10.7m (36ft)	£46.75	£46.00
DD 7/14/21/28L length 21m (69ft)	£58.50	£58.00
DDM 14 length 10.7m (36ft)	£15.98	£15.28
DDM 21 length 7m (24ft)	£11.64	£11.50
DDM 28 length 5.8m (19ft)	£11.64	£11.50

(28L antennas operate in the lower half of the band only, unless an ATU is used) Money back GUARANTEE if purchaser not satisfied if antenna returned undamaged within one month.

# HATELY ANTENNA TECHNOLOGY

1 Kenfield Place, ABERDEEN AB1 7UW  
SCOTLAND, UK

Proprietor:- Maurice C Hateley, B Sc (Eng), M Sc, MIEE, Chartered Electrical Engineer, (GM3HAT)

(NB We will be Exhibiting at the Anglo-Scottish Rally at Tait Hall, Kelso 6th May)

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<b>COMPUTER ICs</b> 6502 380p 6522A 380p 6800 290p 6800B 450p 6801 345p 6809 750p 68809 1150p 6809E 995p 6810 120p 6821 160p 68821 215p 6840 390p 68840 580p 6844 1295p 6845 795p 6850 140p 6852 250p 6854 680p 6875 990p 8126A 120p 8128 120p 8195 90p 8196 90p 8197 90p 8198 90p 8025L 340p 8039L 320p 8080A 360p 8085A 450p 8155 450p 8212 155p 8213 100p 8224 160p 8226 195p 8228 250p 8251 300p 8253 450p 8255 280p 8257 450p 8259 450p 8259 450p 9017 12p 9018 12p 9019 12p 9020 12p 9021 12p 9022 12p 9023 12p 9024 12p 9025 12p 9026 12p 9027 12p 9028 12p 9029 12p 9030 12p 9031 12p 9032 12p 9033 12p 9034 12p 9035 12p 9036 12p 9037 12p 9038 12p 9039 12p 9040 12p 9041 12p 9042 12p 9043 12p 9044 12p 9045 12p 9046 12p 9047 12p 9048 12p 9049 12p 9050 12p 9051 12p 9052 12p 9053 12p 9054 12p 9055 12p 9056 12p 9057 12p 9058 12p 9059 12p 9060 12p 9061 12p 9062 12p 9063 12p 9064 12p 9065 12p 9066 12p 9067 12p 9068 12p 9069 12p 9070 12p 9071 12p 9072 12p 9073 12p 9074 12p 9075 12p 9076 12p 9077 12p 9078 12p 9079 12p 9080 12p 9081 12p 9082 12p 9083 12p 9084 12p 9085 12p 9086 12p 9087 12p 9088 12p 9089 12p 9090 12p 9091 12p 9092 12p 9093 12p 9094 12p 9095 12p 9096 12p 9097 12p 9098 12p 9099 12p 9100 12p 9101 12p 9102 12p 9103 12p 9104 12p 9105 12p 9106 12p 9107 12p 9108 12p 9109 12p 9110 12p 9111 12p 9112 12p 9113 12p 9114 12p 9115 12p 9116 12p 9117 12p 9118 12p 9119 12p 9120 12p 9121 12p 9122 12p 9123 12p 9124 12p 9125 12p 9126 12p 9127 12p 9128 12p 9129 12p 9130 12p 9131 12p 9132 12p 9133 12p 9134 12p 9135 12p 9136 12p 9137 12p 9138 12p 9139 12p 9140 12p 9141 12p 9142 12p 9143 12p 9144 12p 9145 12p 9146 12p 9147 12p 9148 12p 9149 12p 9150 12p 9151 12p 9152 12p 9153 12p 9154 12p 9155 12p 9156 12p 9157 12p 9158 12p 9159 12p 9160 12p 9161 12p 9162 12p 9163 12p 9164 12p 9165 12p 9166 12p 9167 12p 9168 12p 9169 12p 9170 12p 9171 12p 9172 12p 9173 12p 9174 12p 9175 12p 9176 12p 9177 12p 9178 12p 9179 12p 9180 12p 9181 12p 9182 12p 9183 12p 9184 12p 9185 12p 9186 12p 9187 12p 9188 12p 9189 12p 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9301 12p 9302 12p 9303 12p 9304 12p 9305 12p 9306 12p 9307 12p 9308 12p 9309 12p 9310 12p 9311 12p 9312 12p 9313 12p 9314 12p 9315 12p 9316 12p 9317 12p 9318 12p 9319 12p 9320 12p 9321 12p 9322 12p 9323 12p 9324 12p 9325 12p 9326 12p 9327 12p 9328 12p 9329 12p 9330 12p 9331 12p 9332 12p 9333 12p 9334 12p 9335 12p 9336 12p 9337 12p 9338 12p 9339 12p 9340 12p 9341 12p 9342 12p 9343 12p 9344 12p 9345 12p 9346 12p 9347 12p 9348 12p 9349 12p 9350 12p 9351 12p 9352 12p 9353 12p 9354 12p 9355 12p 9356 12p 9357 12p 9358 12p 9359 12p 9360 12p 9361 12p 9362 12p 9363 12p 9364 12p 9365 12p 9366 12p 9367 12p 9368 12p 9369 12p 9370 12p 9371 12p 9372 12p 9373 12p 9374 12p 9375 12p 9376 12p 9377 12p 9378 12p 9379 12p 9380 12p 9381 12p 9382 12p 9383 12p 9384 12p 9385 12p 9386 12p 9387 12p 9388 12p 9389 12p 9390 12p 9391 12p 9392 12p 9393 12p 9394 12p 9395 12p 9396 12p 9397 12p 9398 12p 9399 12p 9400 12p 9401 12p 9402 12p 9403 12p 9404 12p 9405 12p 9406 12p 9407 12p 9408 12p 9409 12p 9410 12p 9411 12p 9412 12p 9413 12p 9414 12p 9415 12p 9416 12p 9417 12p 9418 12p 9419 12p 9420 12p 9421 12p 9422 12p 9423 12p 9424 12p 9425 12p 9426 12p 9427 12p 9428 12p 9429 12p 9430 12p 9431 12p 9432 12p 9433 12p 9434 12p 9435 12p 9436 12p 9437 12p 9438 12p 9439 12p 9440 12p 9441 12p 9442 12p 9443 12p 9444 12p 9445 12p 9446 12p 9447 12p 9448 12p 9449 12p 9450 12p 9451 12p 9452 12p 9453 12p 9454 12p 9455 12p 9456 12p 9457 12p 9458 12p 9459 12p 9460 12p 9461 12p 9462 12p 9463 12p 9464 12p 9465 12p 9466 12p 9467 12p 9468 12p 9469 12p 9470 12p 9471 12p 9472 12p 9473 12p 9474 12p 9475 12p 9476 12p 9477 12p 9478 12p 9479 12p 9480 12p 9481 12p 9482 12p 9483 12p 9484 12p 9485 12p 9486 12p 9487 12p 9488 12p 9489 12p 9490 12p 9491 12p 9492 12p 9493 12p 9494 12p 9495 12p 9496 12p 9497 12p 9498 12p 9499 12p 9500 12p 9501 12p 9502 12p 9503 12p 9504 12p 9505 12p 9506 12p 9507 12p 9508 12p 9509 12p 9510 12p 9511 12p 9512 12p 9513 12p 9514 12p 9515 12p 9516 12p 9517 12p 9518 12p 9519 12p 9520 12p 9521 12p 9522 12p 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9634 12p 9635 12p 9636 12p 9637 12p 9638 12p 9639 12p 9640 12p 9641 12p 9642 12p 9643 12p 9644 12p 9645 12p 9646 12p 9647 12p 9648 12p 9649 12p 9650 12p 9651 12p 9652 12p 9653 12p 9654 12p 9655 12p 9656 12p 9657 12p 9658 12p 9659 12p 9660 12p 9661 12p 9662 12p 9663 12p 9664 12p 9665 12p 9666 12p 9667 12p 9668 12p 9669 12p 9670 12p 9671 12p 9672 12p 9673 12p 9674 12p 9675 12p 9676 12p 9677 12p 9678 12p 9679 12p 9680 12p 9681 12p 9682 12p 9683 12p 9684 12p 9685 12p 9686 12p 9687 12p 9688 12p 9689 12p 9690 12p 9691 12p 9692 12p 9693 12p 9694 12p 9695 12p 9696 12p 9697 12p 9698 12p 9699 12p 9700 12p 9701 12p 9702 12p 9703 12p 9704 12p 9705 12p 9706 12p 9707 12p 9708 12p 9709 12p 9710 12p 9711 12p 9712 12p 9713 12p 9714 12p 9715 12p 9716 12p 9717 12p 9718 12p 9719 12p 9720 12p 9721 12p 9722
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# One Night's Work

Here is another useful little project from Stephen Ibbs, IF oscillators which will greatly assist alignment.

When aligning/tuning up receivers, it will be found that a crystal IF oscillator is a very useful piece of test gear. All it does is to oscillate at the IF frequency, but when placed close to the IF stages, the two frequencies beat together, producing an audible note. The receiver IF can then be tuned for zero beat, with the knowledge that it is now on frequency. The rest of the receiver can then be aligned using this as the reference point.

## Two circuits

The two most common IFs are 10.7MHz and 455kHz, and so two circuits are given here, both using a 74LS00 TTL IC as the

oscillator. Very little need be said about the circuits, which are slightly different because the frequencies are so separated that a common oscillator circuit wouldn't really have been feasible. Both circuits have a 5.1V zener diode incorporated so that they can be powered from any voltage from approx 7-15V, the most convenient being a PP3 9V battery.

Though not tried in the prototype, it should be possible to use a ceramic resonator (cheaper than a 455kHz crystal) with minor modifications to the one circuit.

A DC blocking capacitor can be placed in the output if desired, eg. 33pF.

Veroboard or PCBs can be used, designs for which are given in the *Figures*. Mount all the components, taking care with the crystal leads. After checking carefully, switch on and adjust the trimmer to give 10.7MHz output. The boards were designed to mount on one side of the smallest standard diecast box, with a battery on the other side. The output, (pin 8) is connected to a short length of wire which projects through the one end of the case, otherwise the metal would effectively screen the oscillator and prevent any RF getting out. SW1 is a miniature push button mounted on the top of the case.

The 455KHz oscillator

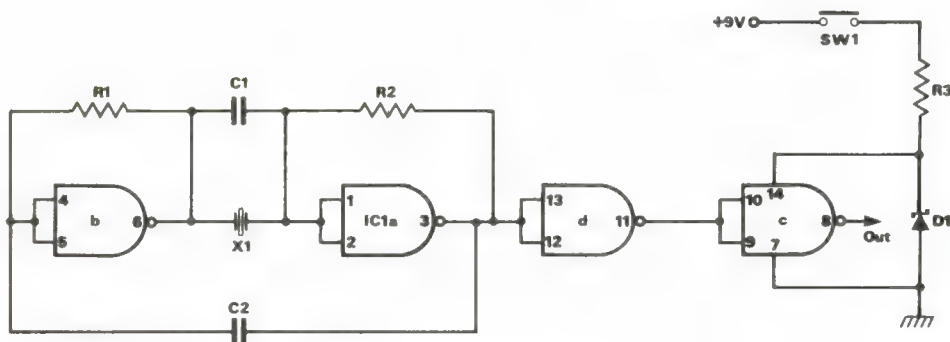
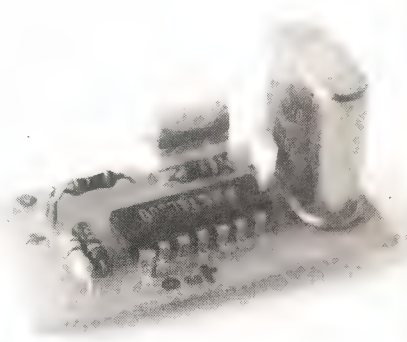


Fig 1a Crystal oscillator circuit



Assembly

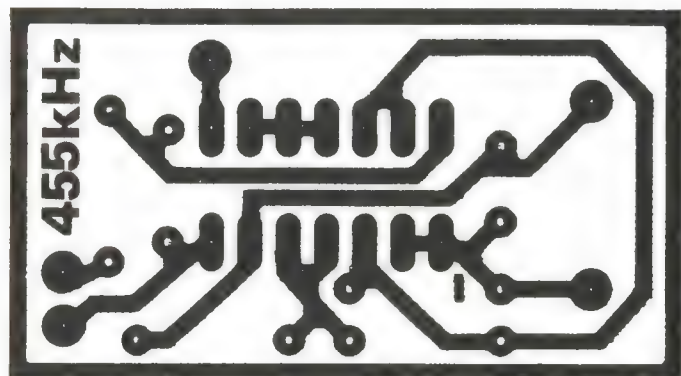


Fig 1b Foil pattern

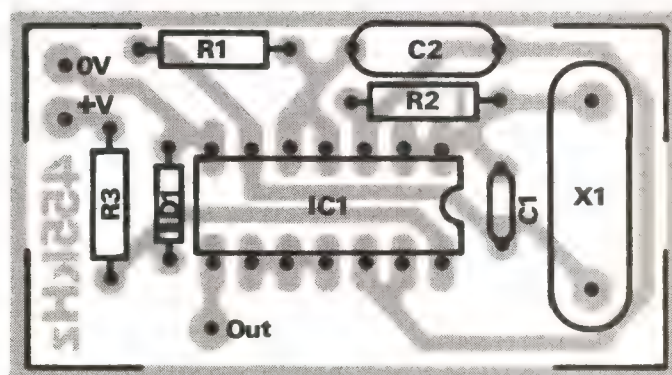
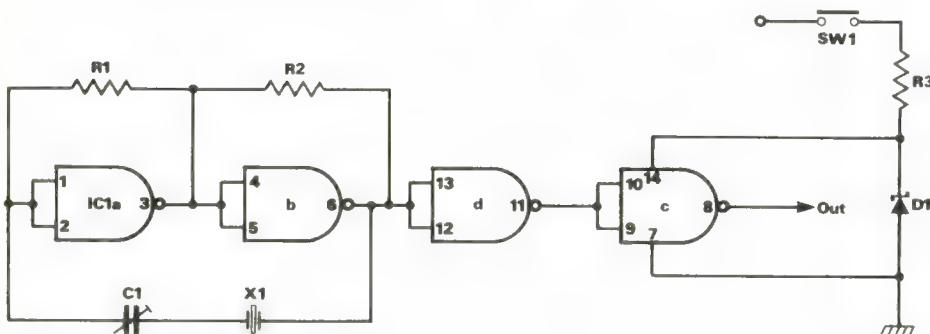


Fig 1c Component overlay

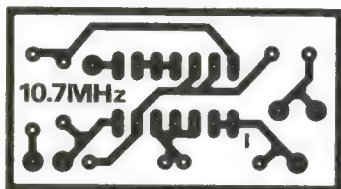


# ONE NIGHT'S WORK

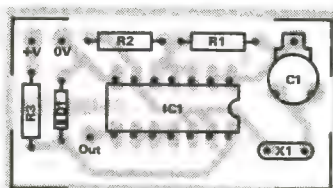
Fig 2 the 10.7 MHz oscillator



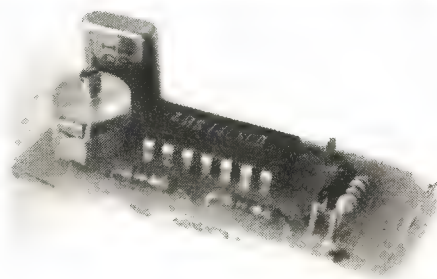
(a) The circuit



(c) Foil pattern



(d) Component overlay



(b) Assembly

## PARTS LIST

455kHz crystal oscillator	
R1, R2	1kΩ
R3	100Ω
C1	220pF ceramic
C2	47nF polyester
D1	5.1V zener diode
IC1	74L 500
X1	455kHz crystal

## PARTS LIST

10.7MHz crystal oscillator	
R1, R2	560Ω
R3	100Ω
C1	5-60pF trimmer
D1	5.1V zener diode
IC	74L 500
X1	10.7MHz crystal

## C M HOWES Communications

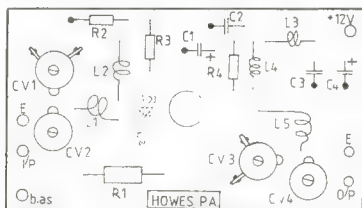
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**PA2/15** Up to 15W output with a gain of approx 10dB, for hand-helds with up to 1½W output and 1W SSB portables. **Kit £18.90, assembled PCB £22.80.**

**PA2/30** Up to 30W output, gain approx 8dB. This unit has been designed to put out a 'clean', narrow signal on SSB with rigs such as the FT290 and IC202. We have not gone all-out for maximum gain, this unit will have plenty of power in hand with these popular rigs, there are too many small 'linears' on the market that try to get too much gain and power out of a 25W transistor with the resultant nasty effects for other band users. Build a linear that will put out a signal you will be proud of. **Kit £22.90, assembled PCB £26.90.** Both the above come complete with preformed inductors, so there is no problem in trying to decypher coil winding instructions! An RF or PTT operated switching unit for the above is available, type **CO1** this uses low-cost relays to give reasonable performance at a sensible price. **Kit £8.90, assembled PCB £11.90.** Yes, there is provision for connecting a pre-amp if you wish.

**AP3 Automatic Speech Processor.** Kit £14.80, assembled PCB £19.80 This is the excellent processor described by Dave, G4KQH in the September 83 edition of 'Ham Radio Today'. We have sold hundreds and hundreds of these and many customers have come back to buy a second, third or even fourth unit for use with their other rigs. The AP3 uses a combination of compression, clipping, and response tailoring to give you a really 'punchy' signal that enables you to make contacts that may not be possible without it. The unit will run from not in use, so saving batteries. Clipping level is selectable in 6dB steps, no other operational controls to fiddle with, operation is fully automatic, speak as loudly or quietly as you like, the AP3 will adjust itself. Suitable for high and low impedance mics.

**DcRx DIRECT CONVERSION COMMUNICATIONS RECEIVER,** Kit £13.95, built £18.90 DcRx is a low cost, easy to build amateur band receiver, designed so that a newcomer to the hobby can build a shortwave receiver with the minimum of trouble. The DcRx is also proving to be very popular with experienced QRP operators.

Two versions of the DcRx are available at the moment, one covering 10 or 14 MHz, and one covering 3.5MHz (80M). The kit comes complete with ready-wound coils and requires very little alignment. You will be amazed how well a simple receiver can work, don't be put off by the low price, this set performs well and is capable of world-wide reception. The DcRx runs from a nominal 12V supply and will drive a loudspeaker or headphones.

Modes: SSB and CW. PCB size 77 by 77 by 25mm approx.

**XM1 CRYSTAL CONTROLLED FREQUENCY MARKER** Kit £15.60, assembled £19.60. A really useful piece of test equipment, besides helping you meet amateur licence frequency measurement requirements. Our kit has a built in voltage stabiliser to maintain accuracy over a wide voltage range (8 to 24V DC). The XM1 provides marker outputs at 1MHz, 100kHz, 25kHz and 10kHz, these are usable up to 70cm, unlike some CMOS designs. The XM1 has a pulsed ident facility for distinguishing markers from off-air signals on crowded bands. This facility is very useful, and much preferable to tone modulated markers, whose bandwidth becomes larger as frequency increases. If you are going to invest in a piece of test equipment, it pays to go for a good quality design, the XM1 provides this.

**ST2 CW SIDE-TONE UNIT or PRACTICE OSCILLATOR** Kit £6.20, built £8.90. The ST2 provides a nice sounding sinewave note, either from your key or from the output of your TX by RF sensing. This design should not be confused with cheap and nasty squarewave circuits so common in horrible sounding practice units. We think side-tone, or a practice oscillator should sound like a good off-air signal received on a quality set. Output is up to approx. 1W at 800Hz, a volume control is included.

An SAE will bring you further information on any item.

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PLUS HUNDREDS OF MAIN LINE ITEMS FROM ICOM, YAESU, FDK, KENWOOD, TRIO, WELZ, TONNA.

'10 METRE' FM MOBILE RIGS '2740' from the company who have converted over '600' units.

**We** have obtained the last 200 units we believe available in the UK. Take this opportunity to obtain any of the following options:-

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2740 as above but inc repeater shift ..... **£10.50 extra inc**

2740 unmodified less crystals ..... **£33.00 inc**

Crystals for above **£4.75** each plus 50p p&p = 2 req'd plus one for repeater shift.

Suitable 25 watt linear 'Relay Switched' only ..... **£16.50 inc**  
plus £1.50 p&p

IF Crystal filter **£2.00** inc + 50p p&p

MOD Sheet for above including improved audio also applies to DNT rigs ..... **£1.00** plus SAE

Delux mic ready wired 5 pin din **£3.50** inc plus 50p p&p.(Also suitable for all VHF rigs).

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Ray Withers. G4KZH

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# HF Linear Amplifier

*This article describes the construction of a 200 watt amplifier, designed by the M-O Valve Company.*

*It will provide excellent linearity and is suitable for professional or amateur use*

## Why use tubes?

An amplifying device may be either a tube or a transistor (bipolar or fet). When the smallness of the transistor, its low voltage operation and absence of heater are regarded as deciding factors, there is no point in advocating the use of a tube. However, tubes do have distinct advantages of their own.

An important one is their better high frequency capability, particularly at output power levels of 50W and over. Examples are the VHF/UHF tubes such as the forced air cooled 4CX250B and its conduction cooled variants the CCS1 and CCS2. There is also the conduction cooled YL1550, which is used in the Clansman military communications system, to give a VHF output of 50W with a low power semiconductor drive circuit.

Glass envelope tubes have a particular advantage concerned with cooling. Transistors

need to be conduction cooled and, if the heat has to be carried away by the chassis, semiconductors elsewhere in the circuit may suffer. A separate system of metalwork, thermally isolated from the chassis, can be used for cooling, but this may be bulkier than the tube which could be used instead. With adequate ventilation it is usually fairly easy to get the heat away from a glass envelope tube and a fan is sometimes used, especially when a large power handling capability is packed into a small space.

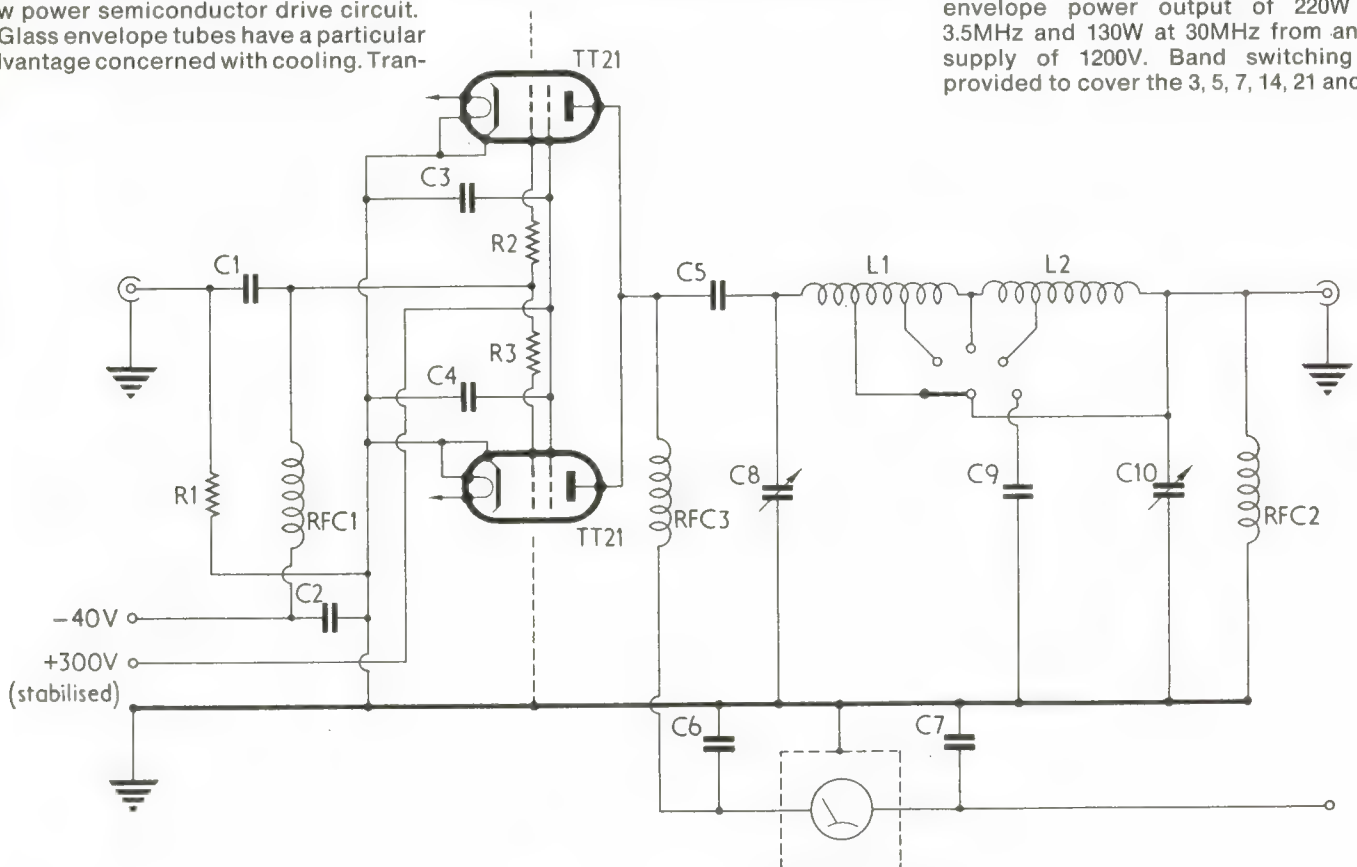
Although the linear amplifier is commonly used in conjunction with a pi-coupler output circuit, which is capable of good harmonic rejection, and further filtering is often added, it is worth noting

that a tube, because of its smoother characteristic, usually generates a rather lower proportion of harmonic output than a transistor. The tube's intermodulation products are also likely to be less, especially at moderate signal levels.

In the absence of faults, one may expect a transistor to have a longer life than a tube, but a tube will usually survive such contingencies as aerial short or open circuits, provided they do not last too long, whereas a transistor may well be burnt out by them. Also, in the event of a failure, a tube is often easier to replace.

## Operating bands

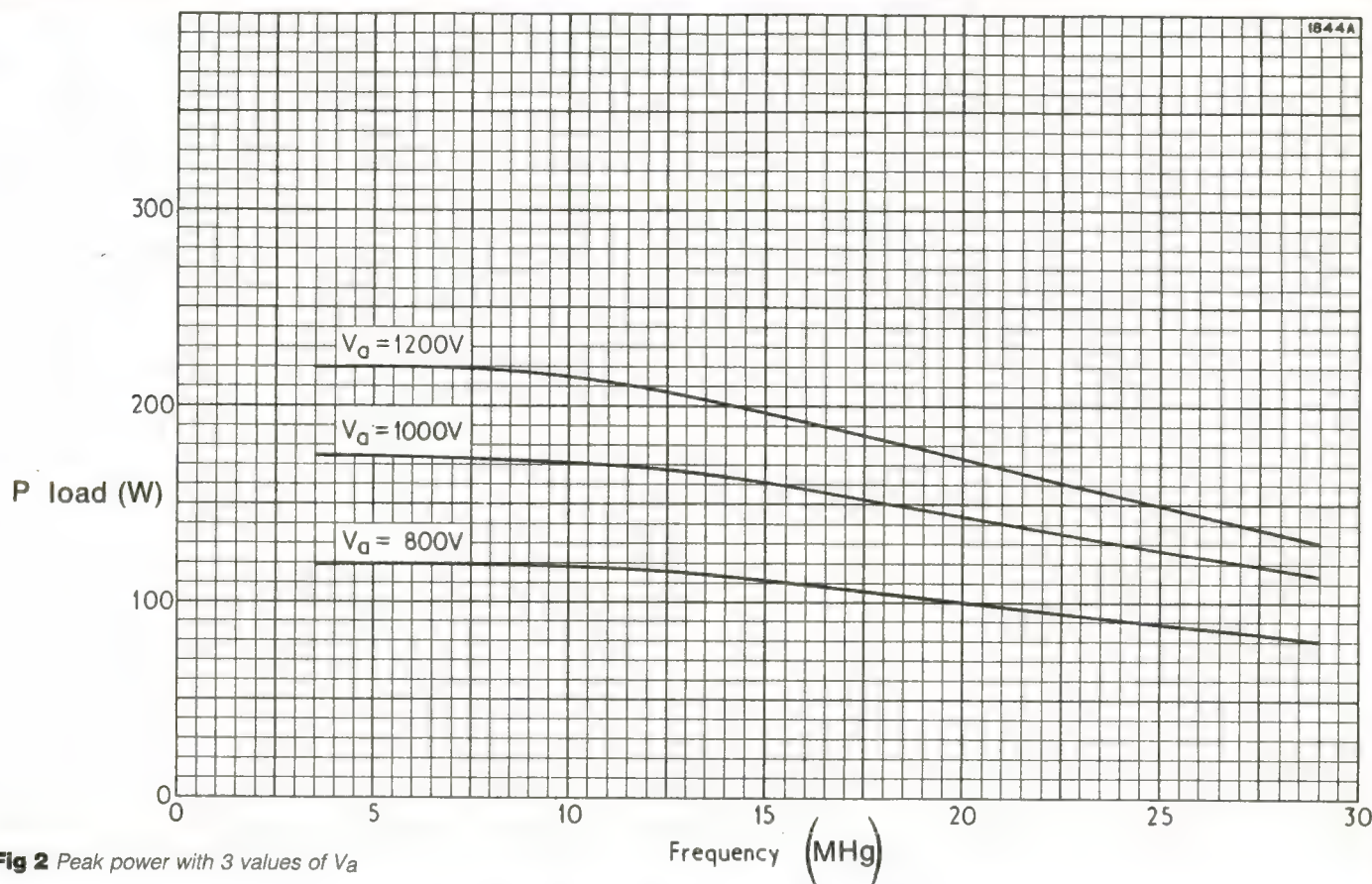
The amplifier is suitable for single sideband transmitters giving a peak envelope power output of 220W at 3.5MHz and 130W at 30MHz from an ht supply of 1200V. Band switching is provided to cover the 3, 5, 7, 14, 21 and 28



**Fig 1** Circuit diagram 200W amplifier



# HF LINEAR AMPLIFIER



**Fig 2** Peak power with 3 values of  $V_a$

MHz amateur bands and could be readily adapted for other frequencies.

## Circuit description

Two TT21 tetrode valves are connected in parallel to a conventional 'pi' output coupling system which provides adjustment for load matching. In order to ensure complete stability without the inconvenience of neutralising, the so called 'passive grid' input circuit is used, in which the input tuned circuit is replaced by a resistor, in this case of 1000Ω. This results in some increase of drive power requirements but the amplifier can be driven to full output with a drive of 5W at 30MHz. The TT21 valves are not driven into grid current and the drive power is dissipated in the grid input resistor and in circuit losses.

## Operating conditions and performance

The peak envelope output power (PEP) obtainable at frequencies up to 30MHz is shown in *Figure 2* for anode voltages of 800, 1000 and 1200V; the corresponding operating conditions are shown in Table 1.

It should be noted that continuous operation at full peak envelope conditions with an anode supply of 1200V is not permissible since the ICAS anode dissipation rating of 45W is exceeded. However, for modulation waveforms having a peak-to-mean ratio greater than 3:1, these conditions are permissible and apply to most practical systems of speech transmission.

The inter-modulation performance is shown on Table 2 under two tone test

conditions; third order inter-modulation of -45dB and fifth order of -46dB relative to either tone is obtainable without the use of feedback.

**Table 2 Inter-modulation Performance**

$V_a$	800	1000	1200	V
$V_{g2}$	300	300	300	V
$-V_{g1}$	34	37	39	V
$V_{g1}$ (pk)	34	37	39	V
$I_a$ (o)	94	75	65	mA
$I_a$ (2 tone)	160	165	180	mA
$I_{g2}$	12	10	8	mA
$I_{g1}$	0	0	0	mA
$P_{load}$ (2 tone)	60	87.5	110	W
D3	45	33	29	dB
D5	46	46	43	dB

**Table 1 Performance of Amplifier**

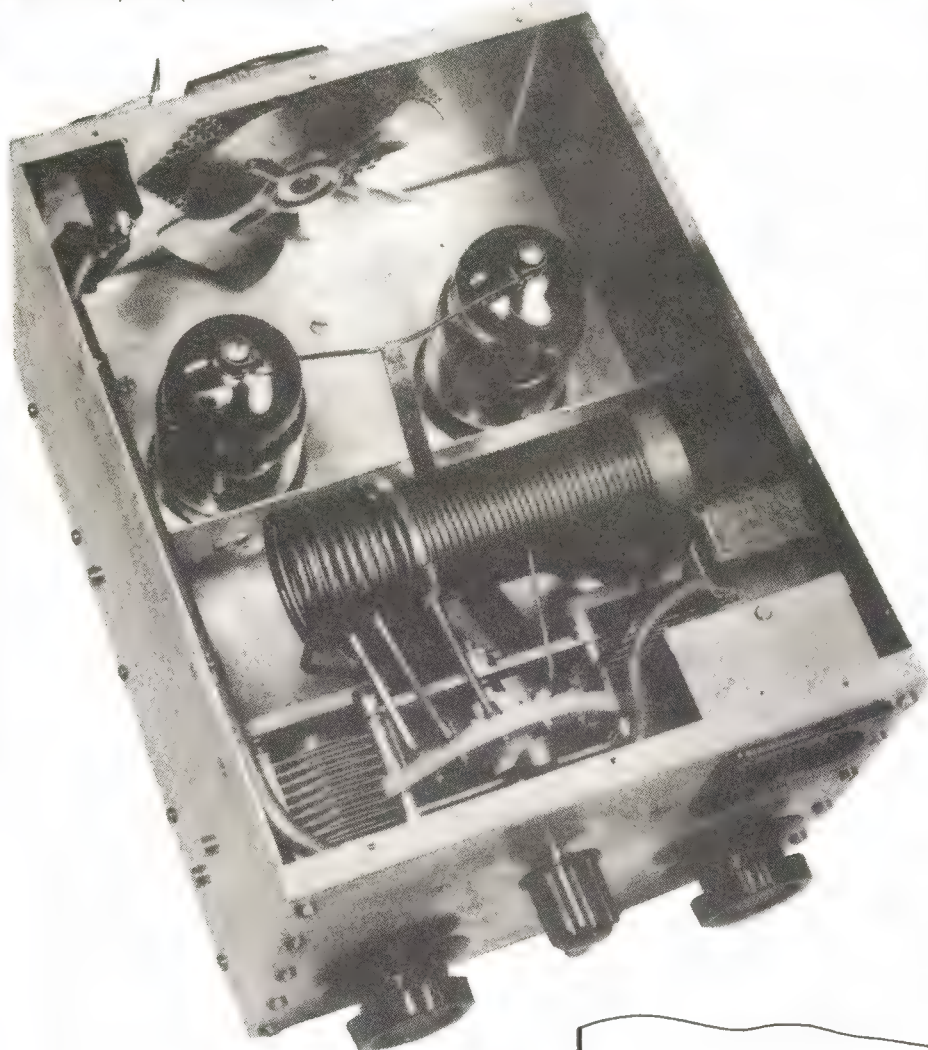
Frequency	≤7	≤7	≤7	14	14	14	21	21	21	29	29	29	MHz
$V_a$	800	1000	1200	800	1000	1200	800	1000	1200	800	1000	1200	V
$V_{g2}$	300	300	300	300	300	300	300	300	300	300	300	300	V
$*V_{g1}$	34	37	39	34	37	39	34	37	39	34	37	39	V
$I_a$ (o) (2 valves)	94	75	62.5	94	75	62.5	94	75	62.5	94	75	62.5	mA
$I_a$ (max sig) (2 valves)	210	260	270	190	230	250	210	240	250	210	215	235	mA
$I_{g2}$ (max sig) (2 valves)	19	18	18	16	16	14	16	16	17	16	16	14	mA
$I_{g1}$ (max sig)	0	0	0	0	0	0	0	0	0	0	0	0	mA
$P_{in}$	168	260	320	152	230	300	168	240	300	168	215	282	W
$P_{load}$	120	175	220	114	167	204	98	140	170	80	115	130	W
$P_{in} P_{load}$ (per valve)	24	43	50	19	32	48	39	50	65	44	50	76	W

\*Adjusted to obtain the stated value of  $I_a$  (o)



# HF LINEAR AMPLIFIER

Top view of amplifier (cover removed)



## Component Values

R1	1000 $\Omega$	2W
R2	100 $\Omega$	1/2W
R3	100 $\Omega$	1/2W

RFC1	2.5mH
RFC2	2.5mH

Meter 0 - 300mA

C1, C2	0.01 $\mu$ F	500V	(0.01 $\mu$ F disc ceramic)
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C3, C4	0.03 $\mu$ F	500V	(3 x 0.01 $\mu$ F disc ceramic)
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C5	2500pF	2.5kV
----	--------	-------

C6, C7	2500pF
--------	--------

C8	17 - 200pF
----	------------

C9	500pF
----	-------

C10	40 - 500pF
-----	------------

## Construction

The amplifier is constructed in an aluminium box 10½in x 8in x 6½in. Because of this small size, positive steps have to be taken to prevent over-heating. The inside faces of the box nearest the valves should be painted matt black in order to reduce reflected heat. The base and top plates and the intermediate shield should have a number of holes around the valves in order to assist natural convection. Some additional air movement is necessary and is provided by a small fan mounted through the rear wall of the box. Checks should be made on prototype equipment that the maximum bulb temperature of the valves does not exceed 250°C under the most onerous conditions of service. Temperature-sensitive paints are convenient for this purpose.

To prevent feed-back in common return circuits, a single earthing point should be established on the chassis midway between the valves (Figure 3). In particular, the two variable capacitors which make up the output tuning system should have their rotors connected to this earth point by a copper strap about 3/16in wide and should not be earthed at

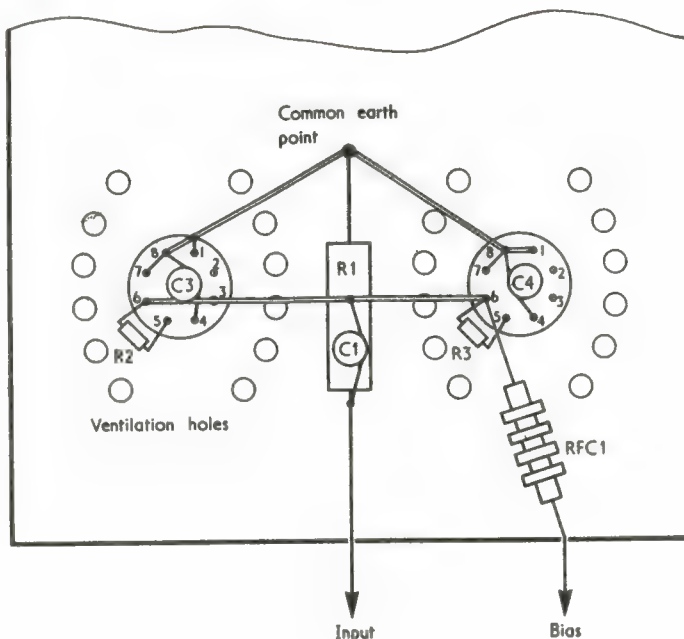


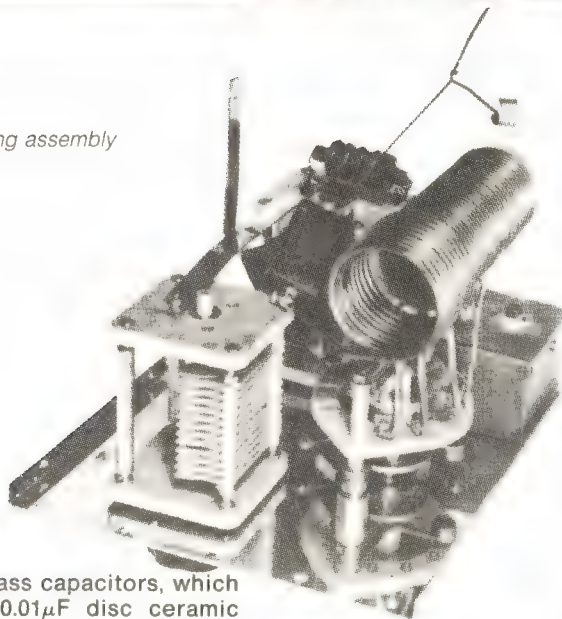
Fig 3 RF connections to valve sockets

any other point. The earthed side of the type N output socket should be similarly returned to the earth point even though it is earthed to the chassis by its mounting.



## HF LINEAR AMPLIFIER

Output tuning assembly



The screen by-pass capacitors, which consist of three 0.01 $\mu$ F disc ceramic types in parallel should be connected directly across the valve holder between pins 4 and 8, since they are concerned only with the rf circulatory currents associated with each separate valve. On the underside of the chassis, the cathode pins of the two valve holders should be separately connected to the earth point by a heavy gauge conductor.

Grid stoppers of 100 $\Omega$  are needed to ensure freedom from parasitic oscillation.

These are connected between pins 5 and 6 of the valve holder, the latter pin having no connection within the valve. A heavy gauge conductor joins pins 6 of the two valve holders and the drive is introduced at the centre of this through a 0.01 $\mu$ F capacitor. With particular circuit layouts, further suppression of parasitic oscillation may be necessary; a 100 $\Omega$  1/4W resistor overwound with 2 1/2 turns of

18SWG copper wire connected close to each anode cap will normally be effective.

### Components

#### Anode Coil

This coil consists of two windings in series; L1 in the circuit diagram consists of 9 turns of 1/8in diameter copper wire with the turns spaced 1/8in and with an internal diameter of 1 1/2in. The entire coil is used at 14MHz/s and taps at 3 and 5 turns from the anode end are used for the 28 and 21 bands respectively. L2 consists of 31 turns of 16SWG wire wound on an epoxy resin former 1 1/2in diameter. The turns are spaced so as to occupy a winding length of 3 1/2in. For use at 7MHz a tap at 12 turns from the anode end is used.

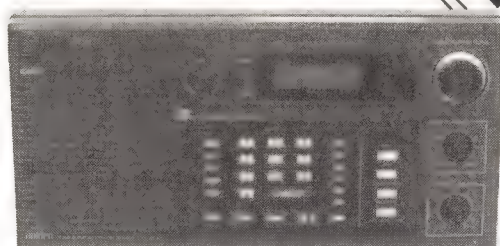
#### Anode Choke (RFC3)

This choke has to have high impedance over the entire frequency range, since it is effectively in parallel with the anode-tuned circuit. A single layer solenoid 1/2in diameter close wound with 24SWG enamelled copper wire to a winding length of 2 1/2in is satisfactory. The connections should be designed to minimise shunt capacitance across the choke.

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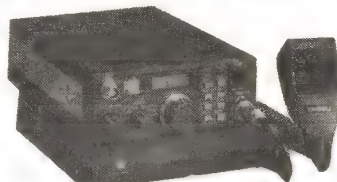
Check out the prices of Yaesu's UHF Transceivers against other manufacturers models and you will probably agree Yaesu leads the way to 70cm.

Just consider with lower equipment costs than equivalent 2M transceivers, a larger number of UHF repeaters in the UK per amateur population than anywhere else worldwide and remember 70cm antennas because of their smaller size and similarity to TV antennas make them far more environmentally acceptable than 2M long Yagis.

\*Need we say more except see you on 70cms!!!



**FT708R**  
Now only  
£179 inc



shown with FL7010  
optional amplifier

**FT790R**  
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**FT730R**  
Now only  
£229 inc

### COAXIAL FEEDERS

Don't throw away those valuable watts by using a poor quality feeder. Remember approximately 20M of UR67 will have an approximate attenuator of 3dB at 432MHz. This means if you invest around £250 for a 100W PA you will only end up with about 50W at the antenna.

UR67	att 3.9dB per 25M approx.....	£0.69 p/m	
Pope H100	att 2.25dB per 25M approx.....	£0.79 p/m	
*Eupen 5121	att 1.4dB per 25M approx.....	£2.93 p/m	NEW
*Andrews LDF2.50	att 1.9dB per 25M approx.....	£3.00 p/m	
*Andrews LDF4.50	att 1.3dB per 25M approx.....	£3.58 p/m	

\*Helical Foam-Dielectric cables

Carriage on cables £2.40 up to 20M over 20M ..... £3.20

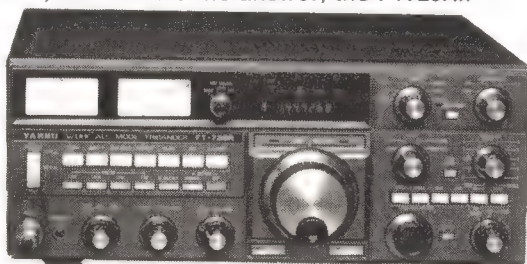
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LW24/70	24 ele Yagi..... £27.02
MBM28/70	28 ele Multibeam..... £21.27
MDB48/70	48 ele Multibeam..... £35.65
MBM88/70	88 ele Multibeam..... £48.87
8XY/70	8 ele crossed Yagi..... £42.55
12XY/70	12 ele crossed Yagi..... £52.90
SMCGP432X	3x3/4 wave colinear..... £32.20
SMCGP714	14 step coaxial colinear 10DBI..... £78.60
SMC70N2V	2/70cm Colinear..... £32.20

NEW

Carriage on antennas..... £2.65

## Looking for a Satellite Transceiver System?

Those clever men at Yaesu have put together your total satellite transceiver requirements in one package. If you are interested in the RS satellite with 2M to 10M transponders, the answer is FT726R + HF module and satellite unit, or if you want to use Oscar 10 with 70cms to 2M transponder, the answer is FT726R + 70cms module and satellite unit. You can even use the FT726R with the mode L transponder on Oscar 10. However in this case the FT726R does require a little help from Microwave Modules and their MMX1268/144. For mode L the answer is FT726R + 70cms module, satellite unit and MMX1268/144 on all the above combinations, full duplex is possible when the satellite unit is fitted to the FT726R. So look no further, Yaesu have the answer, the FT726R!!



FT726R (2)	Transceiver c/w 2M .....	£739.00 inc
FT726R	Transceiver Main frame .....	£589.00 inc
21/24/28	HF Module.....	£200.00 inc
50/726	6M Module .....	£185.00 inc
144/726	2M Module .....	£155.00 inc
430/726	70cms module.....	£250.00 inc
SAT726	Full duplex module.....	£95.00 inc
XF455MC	600 Hz CW filter .....	£39.85 inc

MMX1268/144 Satellite transmit transverter..... £135.00 inc

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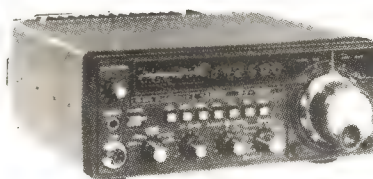
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The ultra compactness of the FT203R is due mainly to Yaesu's chip component circuit board assembly, the chip components being installed automatically by robots. The 203's features include thumbwheel frequency selection, built in S/PO meter, 2.5W RF O/P at 10.8V, (3.5W O/P with FNB4). Vox activated switching is possible when used in conjunction with YH-2. Accessories supplied include FNB3, FTE-2 tone unit, CSC6 case and YHA-14A antenna.

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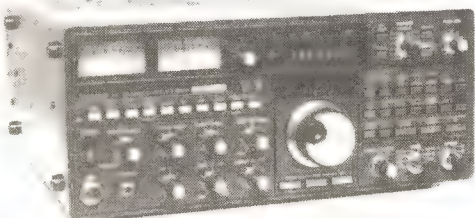
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### FT980



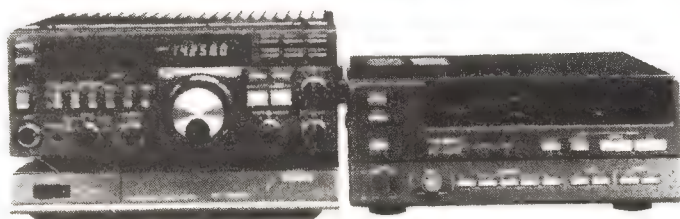
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\* 100% duty cycle only with the FP757HD.

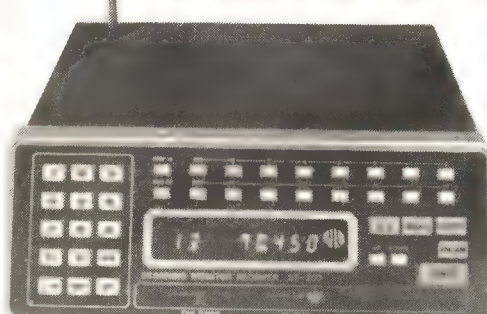
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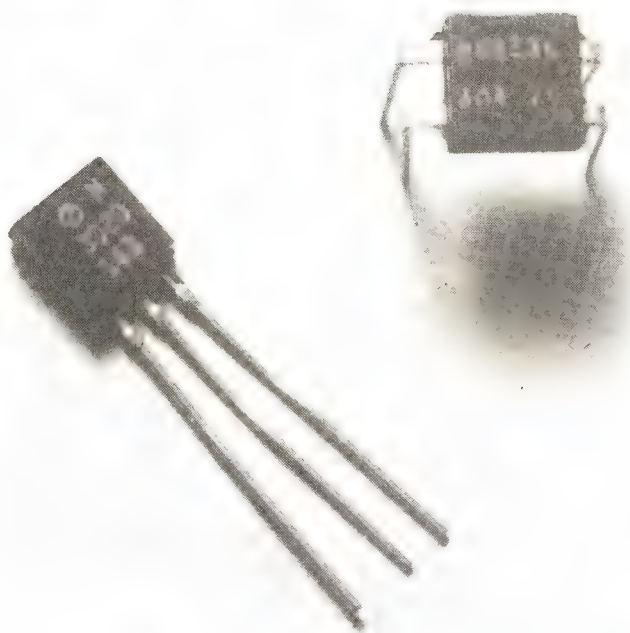
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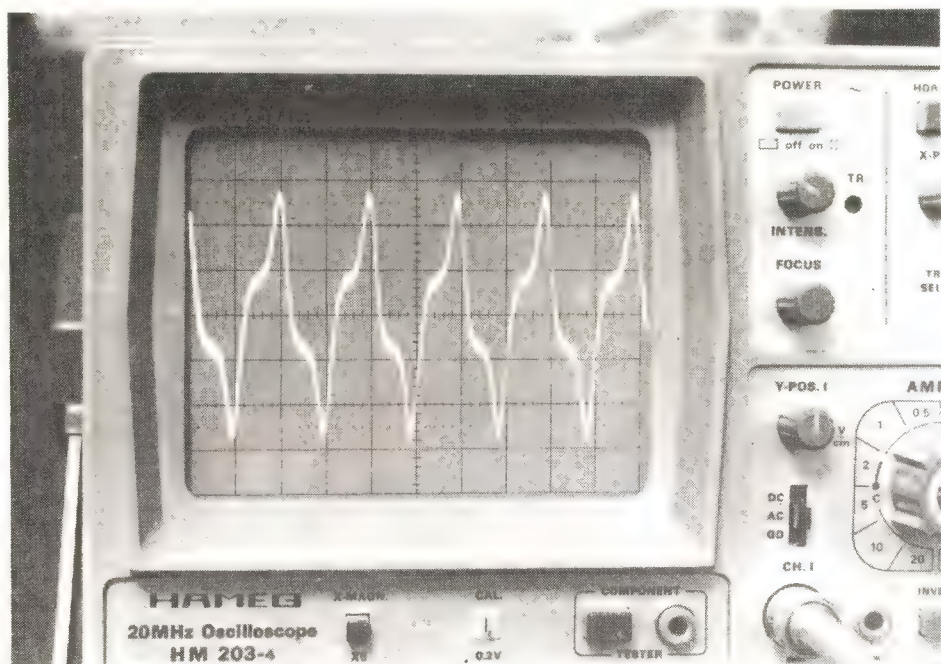


# HALL EFFECT DEVICES

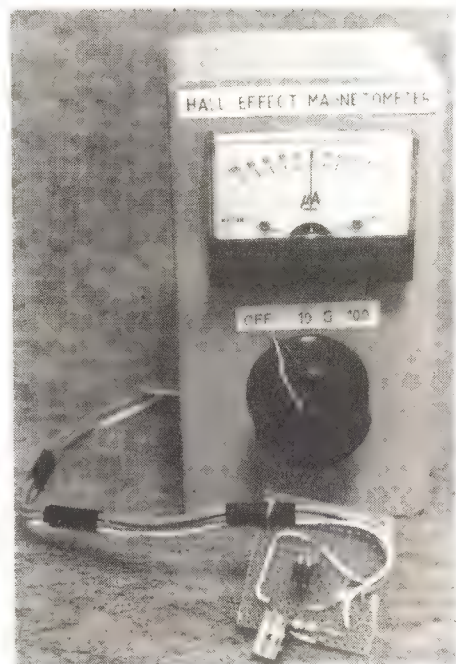
**James Dick  
takes a look  
at two  
devices  
which exploit  
magnetism's  
effect on  
conductors.**



*The Sprague 3020 and 634552 Hall effect devices*



*Oscilloscope trace of signal obtained from placing sensor in magnetic field of small transformer*



*Hall effect Magnetometer with sensor mounted on bare board in front of main unit*

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Faraday, some ten years later, discovered that not only did an electric current produce a magnetic field but that a changing magnetic field would induce a current in a conductor – this interaction between magnetism and electricity is

now known as electro-magnetic induction.

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## **The Hall effect**

One of the consequences of the interplay between magnetism and

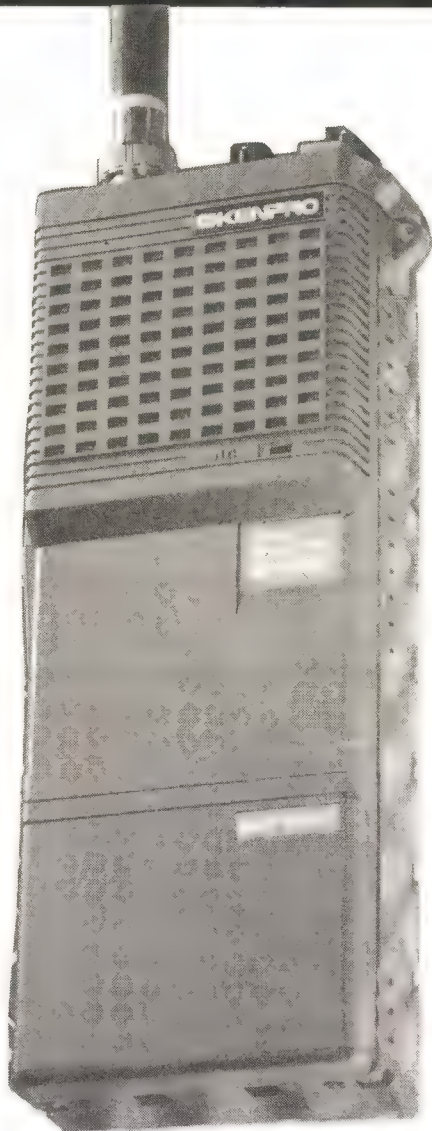
electricity is that placing a current-carrying conductor in a magnetic field causes it to experience a force; the electric motor relies on this phenomenon to turn its rotor. Because the current is the net effect of a large number of moving electrons, it is reasonable to assume that force experienced by the conductor is the result of the sum of the forces undergone by the electrons – and so each electron is subjected to an individual force. The



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# HALL EFFECT DEVICES

result of the force on each electron manifests itself as a migration of the electrons to one side of the conductor. The surplus density of electrons on one side creates a potential difference across the sides of the current-carrying conductor when it is in a magnetic field. The phenomenon was discovered in 1879 by E H Hall, after whom it is named.

Figure 1 shows what happens. The force on the electrons acts orthogonally to the direction of the current and the magnetic field – so it pushes them to one of the side walls of the conductor. The charge builds up until the electrostatic force acting on like-sign carriers balances the magnetic force.

The magnitude of the Hall voltage is given by the expression:

$$V_{\text{Hall}} = \frac{BI}{nQW}$$

where B is the magnetic field, I the current, Q the electron's charge, n the density of charge carriers, and W, the width of the conductor.

## Unit of flux density

For a given size of conductor, the Hall voltage can be optimised by increasing the current carried and minimising the density of charge carriers. Semiconductors are preferred because the carrier density is low – although high enough to allow suitable currents to be passed. While the Hall voltage is created by electrons in conductors, the dominant charge carrier may be positive or negative in semiconductors (depending on the semiconductor type) and hence the potential is signed accordingly. Typically, a small volume of semiconductor will generate a millivolt or so with a few milliamps of current per Gauss; conductors carrying a few amps only produce a few microvolts.

The Gauss is a convenient unit of magnetic flux density – the Earth's magnetic field is approximately 0.5 Gauss. Magnets around the home may have field strengths of several hundred Gauss. Perhaps the strongest fields are those around pulsars where incredibly high densities of matter support fields of one million million Gauss which are believed to cause electron-positron annihilation – one hypothesised source for the pulsar's electromagnetic emissions.

## Devices

The Hall voltage may be measured by connecting wires onto the sides of the (semi-)conductor. Once brought outside the source, it may be processed as required. There are two common device types which use the Hall effect. The first is the magnetic switch, typified by the Sprague 3020 – a low-cost digital switch whose interior is shown schematically in Figure 2.

The sensor, amplifier, and Schmitt

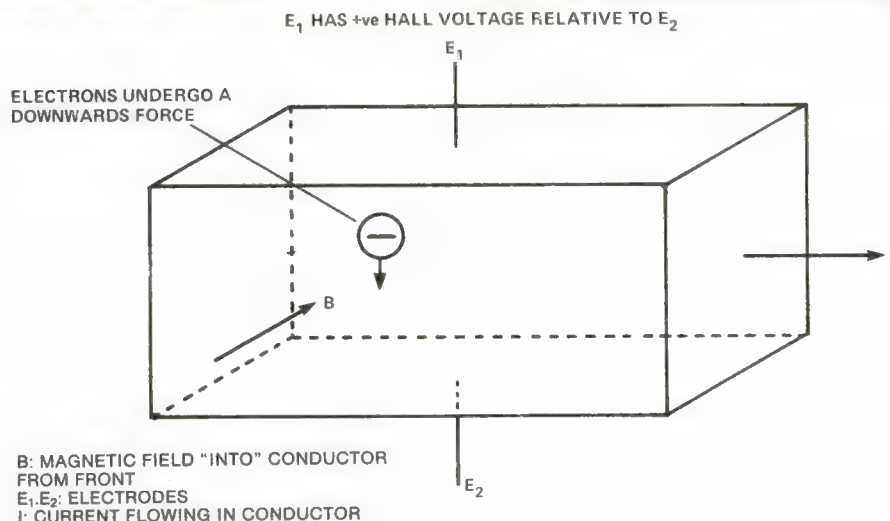


Fig 1 Schematic of Hall effect on current-carrying conductor

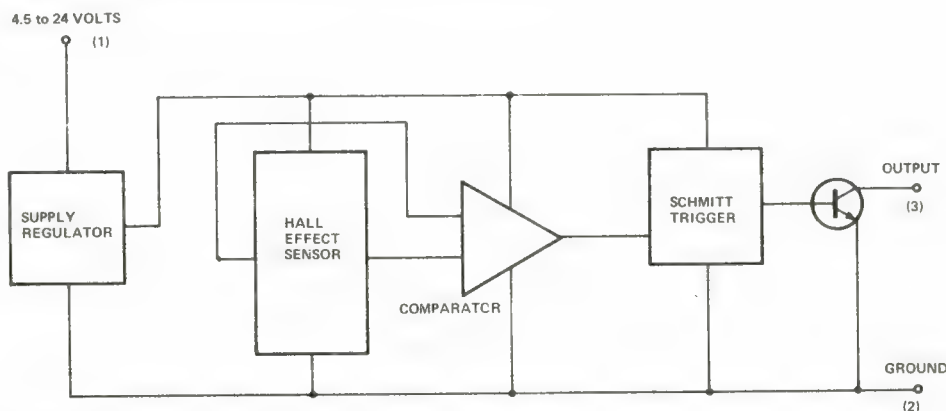


Fig 2 Schematic of Sprague 3020-type Hall effect switch

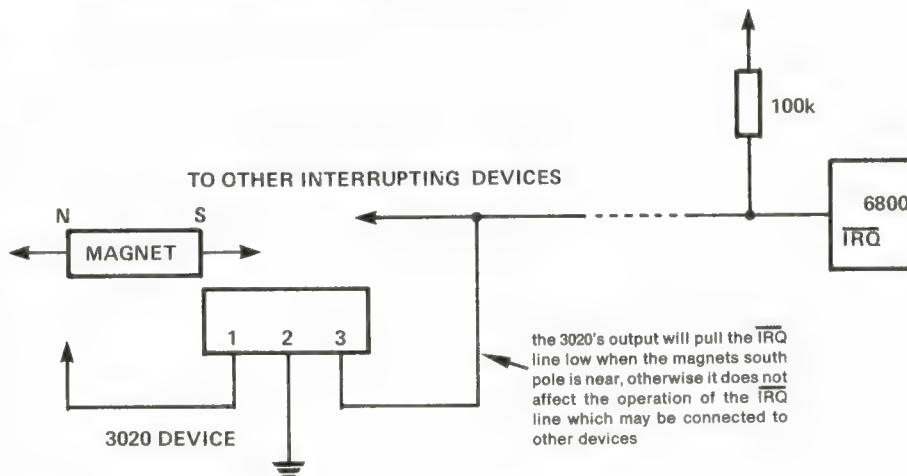
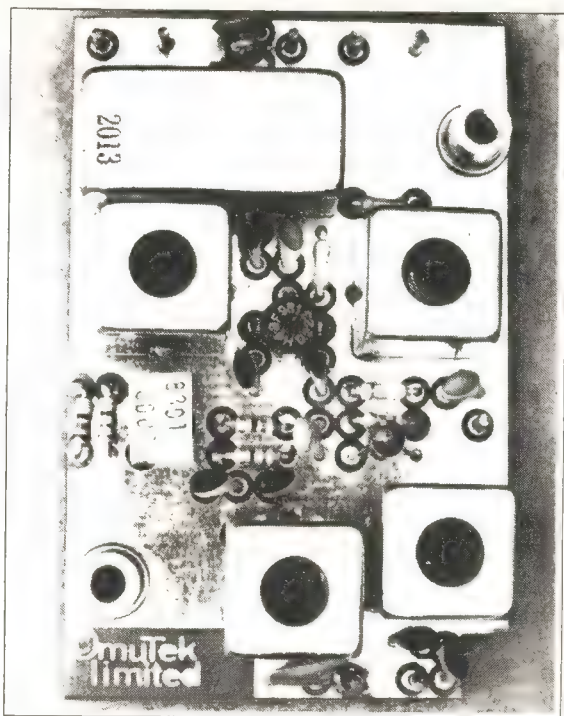


Fig 3 Using the 3020's open-collector output to drive a 6800 microprocessor's  $\overline{\text{IRQ}}$  line

trigger are supplied via a voltage regulator to stabilise the switch against changes in supply potential. The amplifier magnifies the potential difference across the sensor and passes the amplified voltage to the trigger circuit to clean-up the level to digital '1' or '0' standards. The output is an open-collector transistor which is used as a current sink – simplifying connection to a bus, for instance. Figure 3 shows a typical application.

By fabricating the various sections on a monolithic structure the good matching of components obtained allows operation over a wide range of temperatures. The magnetic field required to operate the switch is (approx) 200 Gauss, with a hysteresis of a few tens of Gauss to prevent erroneous switching when the field strength is near the critical value. The Hall effect is sensitive to the polarity of the field, so it is important to use the correct 'end' of the magnet – with this





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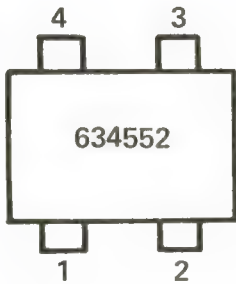
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# HALL EFFECT DEVICES



PIN	FUNCTION
1	GROUND
2	} HALL VOLTAGE OUTPUTS
3	
4	POSITIVE SUPPLY

Fig 4 634552 pin-out

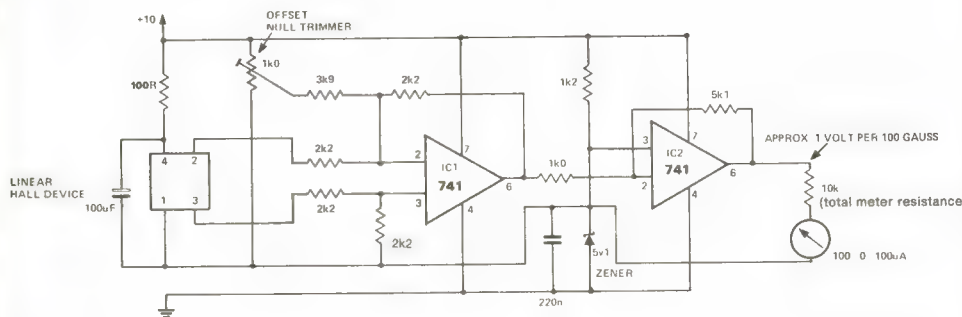


Fig 5 Simple DC amplifier for use with the 634552 device

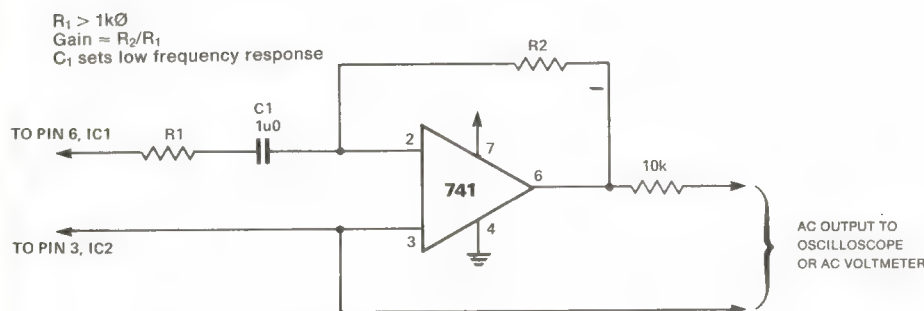


Fig 6 AC amplifier for oscillating fields

device, as the South pole of the magnet approaches the sensor, the output transistor is switched on.

The other type of sensor allows the user to have access to the Hall voltage. The 634SS2, available from Maplin, RS Components, and other suppliers, has the pin-out shown in Figure 4. Two supply connections are used to provide the basic current from which the Hall effect is derived, and two signal connections allow extraction of the Hall voltage – one

output increases by approximately one millivolt per Gauss while the other decreases. The exact potential developed is dependent on the supply voltage and load on the outputs. The device is reasonably linear over a range of -400 to +400 Gauss. Note that the potential between the outputs is not zero for a zero magnetic field; offsets in Hall devices can easily be caused by the non-alignment of the Hall voltage taps on the sensing semiconductor.

## Measurements

A simple circuit to measure the output is shown in Figure 5. The sensor is placed on a remote board to allow movement of the sensor – a calibration coil may also be attached to this board, and its construction is described later. Audio coaxial cable carries the transducer's output to the straightforward DC amplifier circuit. IC1 is a DC-coupled differential amplifier which nulls most of the bias voltage on the outputs; a potentiometer, VR1, is used to remove the remaining bias between the inputs which is present even when there is no external magnetic field. IC2 acts as a simple DC amplifier to multiply the residual signal from IC1. If only alternating magnetic fields were of interest, IC2 and its associated components could be replaced by the AC equivalent shown in Figure 6 with output to an oscilloscope.

The range of magnetic fields that can be measured (as calculated from the manufacturer's data) is 1 to 500 Gauss (approx). Because it is difficult to calibrate the instrument, the readings are best interpreted as a guide to the field strength – use of the probe shows how rapidly the magnetic flux from a simple bar magnet decreases with distance from the magnet; comparing the flux density at the transducer caused by a magnet physically touching the plastic package and that of a magnet with a package-magnet distance of 1mm, shows a 25% drop.

The Hall effect sensor and its circuit shown in Figure 5 may be roughly calibrated by passing a known current through a coil as shown in Figure 7. The magnetic field at the centre of a scramble-wound coil of minimal length may be shown to be

$$B = \frac{CNI}{R} \text{ Gauss}$$

where N is the number of turns in the coil, i is the current, R is the radius of the coil, and C is a constant of value  $6.282 \times 10^{-7}$ . (MKS system of units)

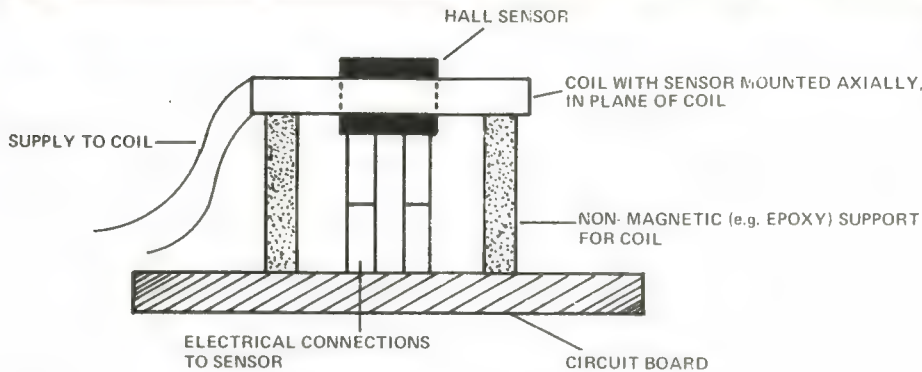
A current of 25mA in a coil of 1cm radius should produce a field of 5 Gauss; as shown by the equation, the field scales directly with the current. Note that in order to achieve the correct coil geometry, fine wire (42 swg) should be used for the 250 turns used as the N in the above equation.

## Applications

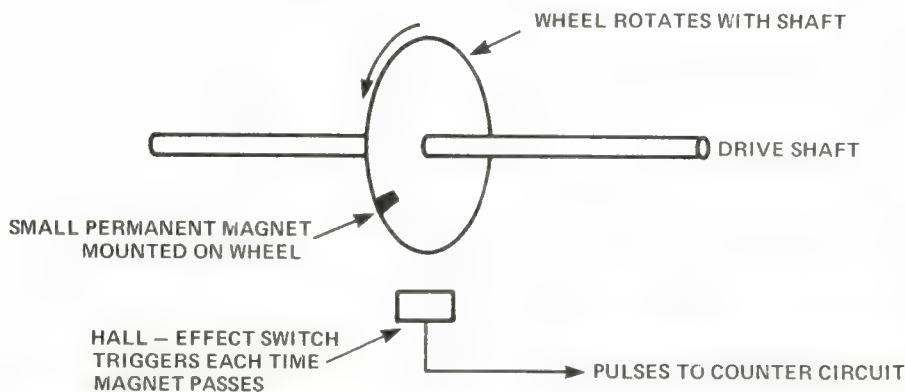
The Hall effect has found its uses in diverse situations. Perhaps the most common use is in keyboard switches. Normal conductive switches use the downward motion of the key to rub two contacts together, or flex a metallic dome onto another connector. With a magnetic switch, the key motion moves a small permanent magnet towards a Hall effect switch, like the 3020 described earlier. When the flux reaches a critical value, the electrical output is activated –



# HALL EFFECT DEVICES



**Fig 7** Location of coil and sensor



**Fig 8** Simple revolution counter

owing to the sensor's hysteresis, there is seldom any problem with bounce.

Because there is no physical switching, there is no danger of a spark (however small) being generated. Hence, Hall effect devices may be used in hazardous environments where a spark could cause an explosion or where the environment may severely corrode any metallic switch contacts.

Linear and rotational motion can be sensed by placing a small permanent magnet on the moving object and siting the Hall effect switch in the object's path as required. *Figure 8* shows how a revolution recorder may be made. There are many situations (in photographic equipment and astronomical instruments, for instance) where light in the visible or infrared parts of the spectrum cannot be tolerated – again the Hall effect switch makes a suitable alternative to the optical encoder or opto-interrupter whose light might stray.

Commercial magnetometers based on Hall devices typically cover field strengths from a few Gauss to a few tens of kilogauss with accuracies round the few per cent level. The Hall effect may seem an ideal method to use – but the flip-coil is still important. This has the advantage of being based on fundamental physical principles – a moving coil in a magnetic field can have its roots traced back to Faraday.



## Northern Amateur Radio Societies Association

The Association is holding its 22nd Annual Radio/Electronics Exhibition at Pontins Holiday Village, Ainsdale, Southport, on Saturday 7th April and Sunday 8th April 1984, opening at 11.00am each day.

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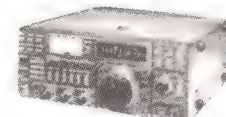
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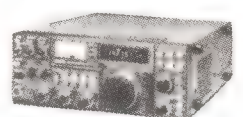
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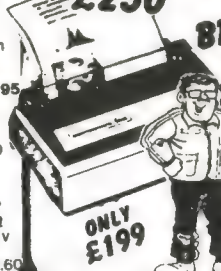
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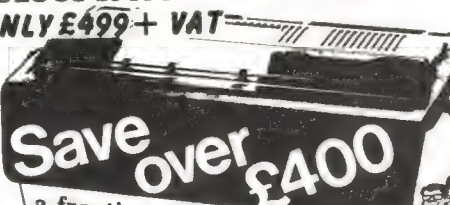
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Compiled by Arthur C Gee, G2UK

## A variety of interesting topics are presented by Dr Gee in this month's article

The British Amateur Radio Teleprinter Group (BARTG) celebrates its Silver Jubilee this year. Your scribe was a founder member of this Group and it seems incredible that twenty five years has passed since he made the first RTTY QSO's in this country with Bill Brennan, G3CQE.

Compared with the Microwave Modules Microprocessor Controlled RTTY-TV Converter – a small black box only 7 x 4½ x 2 inches in size – and its TV VDU

monitor, used by the writer now, the equipment used in those early experiments, which practically filled the shack, is nothing short of a miracle of miniaturisation.

One of the chief complaints about RTTY equipment in those early days was the noise the printer made! Nowadays, with a modern transceiver, an up to date RTTY computerised terminal unit, a VDU, a computer keyboard and a computer type printer, you can get the whole lot on

the smallest of shack benches. And if you already have a home computer, the set-up can be even smaller. And as the whole lot makes no noise whatsoever, even the xyl cannot complain on this score!

### The shuttle

Postmortems on the Shuttle amateur radio experiment continue, with the amateur radio journalists vying with one another in their attempts to describe the exercise! We will say no more than we did before – it was Bedlam! However, five British radio amateurs are officially credited with contacts. They are – G4UYL, G6DEF, G6EGY, GM8NXC and GW60JK. Our congratulations to them.

### The satellites

A new term has appeared in the satellite field, viz., the 'eclipse season'. As its name suggests, this is the period when the satellite is in the Earth's shadow for a sufficient period of time to affect its operation. The Earth's shadow is a variable feature because of its change in relationship between the earth and the sun, which of course is also responsible for our winter and summer seasons. It is even apparent on OSCAR-10, which was in an eclipse state for some weeks, but came out of it towards the beginning of January. Since then, the available solar energy has increased, so the battery state has improved. At the time of writing, OSCAR 10 has been 'turned off' from its position around its elliptical orbit (designated by the term 'Mean Anomaly' from MA 40 to MA 220, which is about one third of its orbit.

The Russian satellites too have been affected by their passage into an eclipse, as we reported previously. They should



Part of the author's amateur radio station, G2UK, showing equipment used in the first RTTY QSO's to take place in this country 25 years ago



be out of eclipse shortly, but will enter it again soon, so it will be sometime yet, before we can enjoy the good service they provided earlier.

There is a rumour that the Russians are building two more satellites of the 'RS' type, ie., they will be in a low, circular orbit, with 29 MHz to 145 MHz transponders, similar to the present ones. The expected date of launch is for 1985.

The date for the launch of the University of Surrey's second satellite is around now, and much interest is being generated by this event. We wish them a successful launch.

### Home computers

These really come into their own in the satellite field.

The 'bright boys' are coming up with all sorts of programs relating to satellites. Everything from orbital calculations to earth shadow patterns. A great variety of programs and tapes are now appearing which makes the application of this type of computer a most interesting field of activity. A recent survey of the makes of home computers used by satellite enthusiasts produced some interesting facts. ZX81's were used by 25%, 24% used the BBC Home computer, 8% used Spectrums, 2% used TRS80's and the rest 'others'.

### Top band

DX on Top Band has been good throughout the winter months, which has resulted in a considerable increase in

activity. This band is a shared band and since the increase in activity some QRM has been caused to its other users. One of these is a French coastal services station on 1820 KHz, which has complained officially about this interference. Amateur operators are asked to be particularly careful to avoid this frequency.

### Ten metres

The 10 metre band has been pretty well closed for long distance use throughout the winter but should open again soon. Before it closed some really good conditions were experienced. On one occasion, fourteen 10 metre beacons could be heard from all around the world.

### 50MHz experimental permits

The number of 50 MHz experimental transmitting licences granted by the Post Office is to be increased from the present forty to one hundred. New aspirants, and those who previously applied and were disappointed, should apply again by 31st March.

The experimental results being obtained by those using this frequency are justifying the extension of this facility. There seems to be a lot of scope still for the amateur radio enthusiast to take part in useful work in the sphere of radio wave propagation.

A good example of this is in relation to Sporadic-E propagation. Long distance communication by means of radio waves takes place because a layer of charged

particles called ions is around the earth. The layer is known as the ionosphere. It occurs in our atmosphere about 25 to 250 miles above the earth and is caused by radiation from the sun.

It can be divided into layers concentric with the earth's surface. Each layer has a maximum density in its middle, thinning out towards its edges. The thickness of the layers and their actual position above the earth are constantly changing depending on solar activity, time of the day and night, and so on. The lowest layer is called the 'D' layer. Above this is the 'E' layer and above that the 'F' layer. Each has its own characteristics. The 'E' layer has the property of being able to refract VHF radio waves, but in a somewhat unusual manner. It seems that it has clouds of ionised particles within it, which are more heavily ionised than the rest of the layer. These may last from a few minutes to hours, and when present, refract any VHF radio waves which may happen to pass through them, over very long distances. These distances are not consistent, neither are the times when the Sporadic-E clouds occur.

Many explanations have been put forward for their occurrence, but no really acceptable theory has yet been put forward. A major investigation is to be undertaken by the Radio Society of Gt Britain to try and throw more light on this phenomenon in which both amateur radio signals and BBC and other short-wave broadcasting station signals will play an important role.

## MOBILE ANTENNAE AND ACCESSORIES



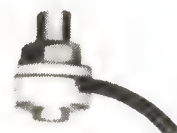
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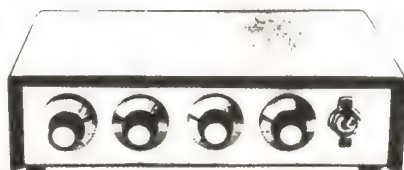
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ditto, but double ended £4.25.

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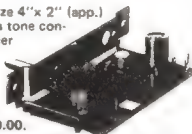
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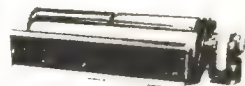
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# DATA FILE

## Ray Marston takes an in-depth look at CMOS bilateral switches and multiplexer/demultiplexer ICs in this latest edition of 'The File'

A CMOS bilateral switch or 'transmission gate' can be regarded as a near-perfect single-pole single-throw (SPST) electronic switch that can pass analogue or digital signals in either direction and can be turned on (closed) or off (opened) by applying a logic 1 or logic 0 signal to a single high-impedance 'control' terminal. Practical versions of such switches have a near-infinite OFF impedance, and a typical ON impedance in the range 90R to 300R.

Standard CMOS bilateral switches can be switched at frequencies ranging from zero to several MHz, and have a multitude of practical uses. They can, for example, be used to replace conventional mechanical switches in signal-carrying applications, the bilateral switch being dc-controlled and placed directly on the PCB where it is needed, thus eliminating the problems of signal radiation and interaction that normally occur when such signals are mechanically switched via lengthy cables.

At higher frequencies, CMOS bilateral switches can be used in such diverse applications as signal gating, multiplexing, A-to-D and D-to-A conversion, digital control of frequency, impedance and signal gain, the synthesising of multi-gang pots and capacitors, and the implementation of sample-and-hold circuits. Examples of most of these applications are shown later in this edition of 'Data File'.

Several types of CMOS 'multiple bilateral switch' ICs are available. These range from the simple 4016B and 4066B types, which each house four independently-accessible SPST bilateral switches, to the 4097B, which houses an array of bilateral switches and logic networks arranged in the form of two independently-accessible single-pole 8-way bilateral switches or multiplexers/demultiplexers. Before we take a detailed look at the range of such ICs, however, let's look at the basic operating principles and terminology, etc, of the bilateral switch.

### Basic operating principles

Figure 1 shows (a) the basic circuit and (b) the equivalent circuit of a simple CMOS bilateral switch. Here, an n-type and a p-type MOSFET are effectively wired in inverse parallel (drain-to-source and source-to-drain), but have their gates biased in anti-phase from the control terminal via a pair of inverters. When the control signal is at logic level '0', the gate of Q2 is driven to VDD and the gate of Q1 is driven to VSS; under this condition both MOSFETs are cut off, and

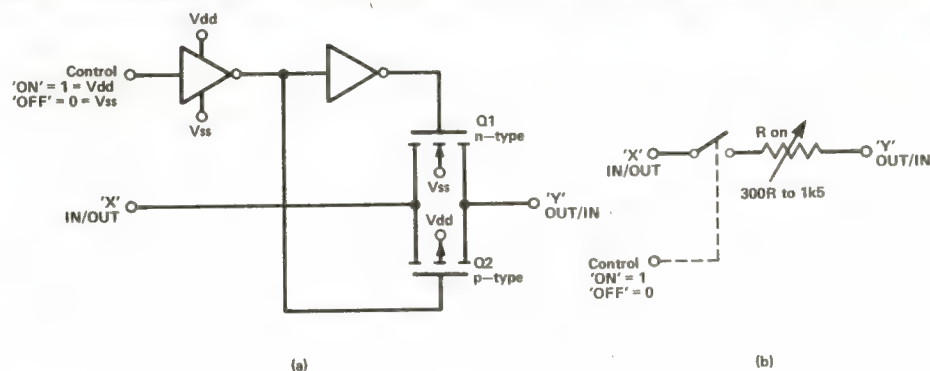


Fig 1 Basic circuit (a) and equivalent circuit (b) of the simple CMOS bilateral switch.

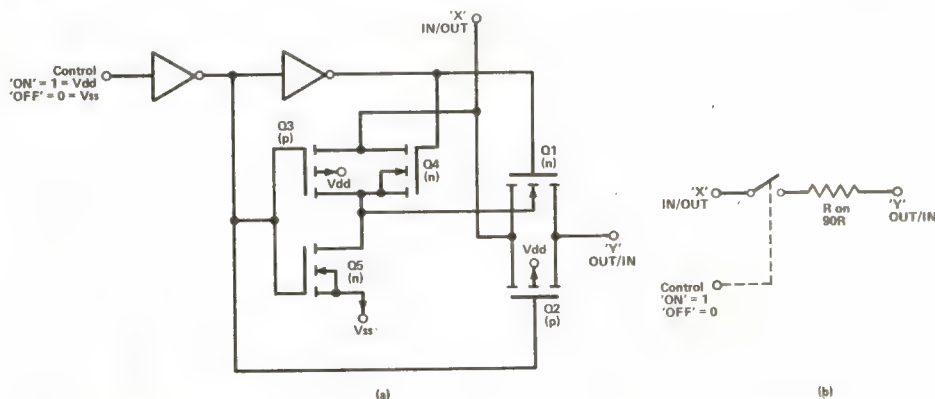


Fig 2 Basic circuit (a) and equivalent circuit (b) of the improved CMOS bilateral switch

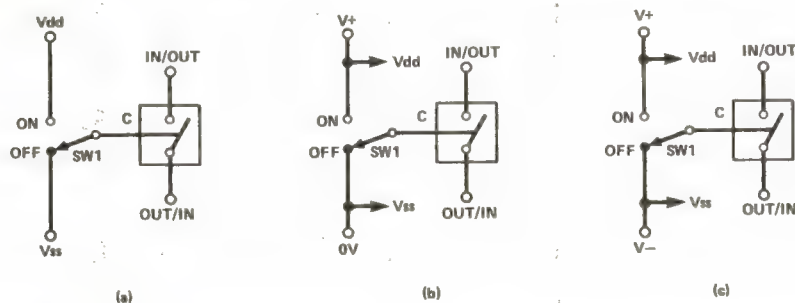


Fig 3 Basic method of turning the bilateral switch on and off (a), and power supply connections for use with (b) digital and (c) analogue IN/OUT signals

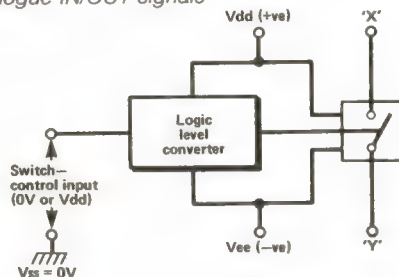
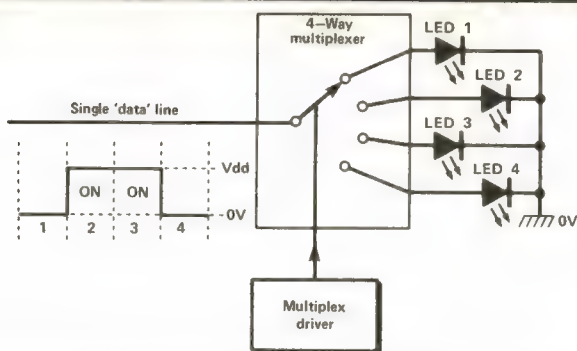
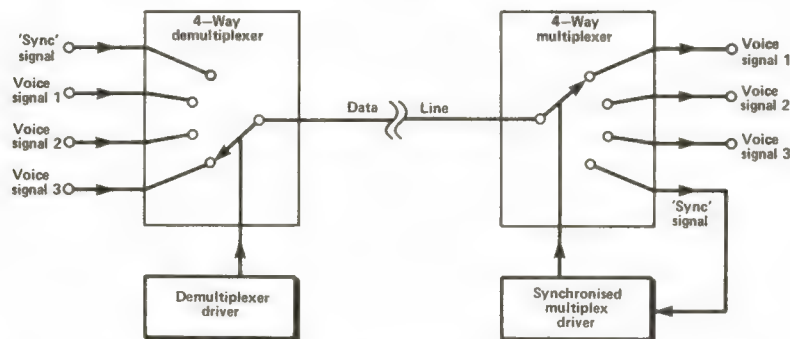


Fig 4 Some ICs feature internal 'logic level conversion', enabling an analogue switch to be controlled via a single-ended input

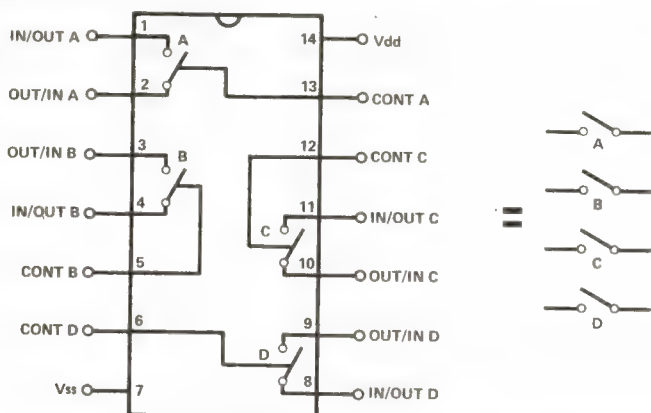




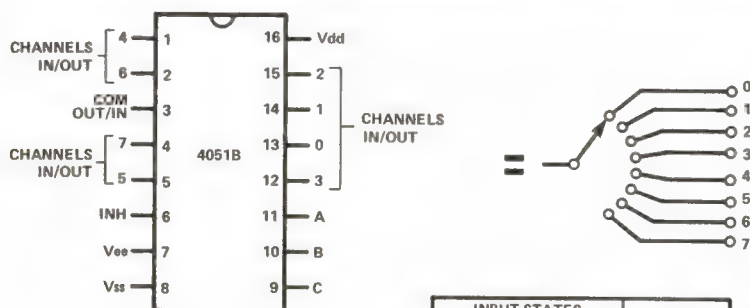
**Fig 5** A 4-way multiplexer used to control four LEDs via a single DATA line



**Fig 6** A 4-way multiplexer/demultiplexer combination used to feed three independent voice signals through a single DATA line



**Fig 7** The 4016B and 4066B quad bilateral switches each act as 4 independent SPST switches



INPUT STATES				'ON' CHANNEL
INH	C	B	A	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	X	X	X	NONE

X = DON'T CARE

**Fig 8** The 4051B 8-channel multiplexer/demultiplexer acts as single-pole 8-way switch

an effective open circuit exists between the 'X' and 'Y' points of the circuit. When, on the other hand, the control signal is at logic level '1', the gate of Q2 is driven to VSS and the gate of Q1 is driven to VDD, and under this condition both MOSFETs are driven to saturation, and a 'near short circuit' exists between the 'X' and 'Y' points of the circuit.

Note that, when Q1 and Q2 are saturated, signal currents can flow in either direction between the 'X' and 'Y' terminals, provided that the signal voltages on these terminals are within the VSS-to-VDD limits. Each of the 'X' and 'Y' terminals can thus be used as either an IN or OUT terminal.

In practice, Q1 and Q2 exhibit a finite resistance ( $R_{on}$ ) when they are saturated, and in this simple circuit the actual value of ( $R_{on}$ ) may vary from 300R to 1k5, depending on the magnitude of the VSS-to-VDD supply voltage and on the magnitude and polarity of the actual input signal. The simple bilateral switch can thus be represented by the equivalent circuit of Figure 1b.

Figure 2 shows an improved version of the CMOS bilateral switch, together with its equivalent circuit. This circuit is similar to the above, except for the addition of a second bilateral switch (Q3-Q4) that is wired in series with Q5, with the 'well' of Q1 tied to Q5 drain. These modifications cause the well of Q1 to switch to VSS when the Q1-Q2 bilateral switch is off, but to be tied to the 'X' input terminal when the switch is on. This modification reduces the ON resistance of the Q1-Q2 bilateral switch to about 90R and virtually eliminates variations in its value with varying signal voltages, etc, as indicated by the equivalent circuit of Figure 2b. The only disadvantage of the Figure 2 circuit is that it has a slightly lower leakage resistance than Figure 1.

## Switch biasing

A CMOS bilateral switch can be used to switch or gate either digital or analogue signals, but must be correctly biased to suit the type of signal being controlled. Figure 3 shows the basic ways of activating and biasing the bilateral switch. Figure 3a shows that the switch can be turned ON (closed) by taking the control terminal to VDD, or turned OFF (open) by taking the control terminal to VSS.

In digital-signal switching applications (Figure 3b) the bilateral switch can be used with a single ended supply, with VSS at zero volts and VDD at a positive value equal to (or greater than) that of the digital signal (up to a maximum of +18 volts). In analogue switching applications (Figure 3c) a split power supply (either true or effective) must be used, so that the signal is held at a mean value of half-supply volts: the positive supply rail goes to VDD, which must have a value greater than the peak positive voltage value of the input signal, and the negative rail goes to VSS and must be greater than the peak negative value of the input signal: the supply values are



limited to  $\pm 9$  volts maximum. Typically, the bilateral switch introduces less than 0.5% of signal distortion when used in the analogue mode.

## Logic level conversion

Note from the above description of the analogue switching system that, if a split power supply is used, the switch control signals must switch to the positive rail to turn the bilateral switch on, and to the negative rail to turn the switch off. This arrangement is inconvenient in many practical applications; consequently, some 'multiple bilateral switch' ICs (notably the 4051B to 4053B family) have built-in 'logic level conversion' circuitry which enables the bilateral switches to be controlled by a digital signal that switches between zero (VSS) volts and positive (VDD), while still using split supplies to give correct biasing for analogue operation, as shown in Figure 4.

## Multiplexing/demultiplexing

A multiplexer can be regarded as any system that enables information from a single 'Data' line to be distributed (on a sequential time/share basis) to a number 'n' of independent data lines. Figure 5, for example shows how a 4-way multiplexer (represented by a 4-way switch) can be used to control (turn on or off) four LEDs down a single data line.

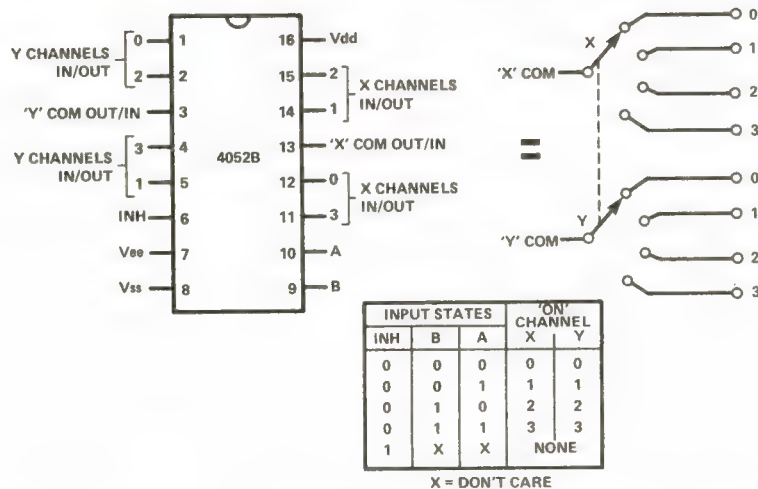
In Figure 5, assume that the multiplex driver continuously sequences the multiplexer through the 1-2-3-4 cycle at a fairly rapid rate, and is synchronised to the 1-2-3-4 segments on the DATA line. Thus, in each cycle, in the '1' period LED 1 is off; in the '2' period LED 2 is on; in the '3' period LED 3 is on, and in the '4' period LED 4 is off. The state of each of the four LEDs is thus controlled via the logic 'bit' of the single (sequentially time/shared) DATA line.

A demultiplexer is the opposite of a multiplexer. It enables information from a number 'n' of independent data lines to be sequentially applied to a single DATA line. Figure 6 shows how a 4-way demultiplexer can be used to feed three independent 'voice' signals down a single cable, and how a multiplexer can be used to convert these signals back into three independent voice signals at the other end. In practice, each 'sample' period of the DATA line must be short relative to the period of the highest voice frequency: Period 1 is used to synchronise the signals at the two ends of the DATA line.

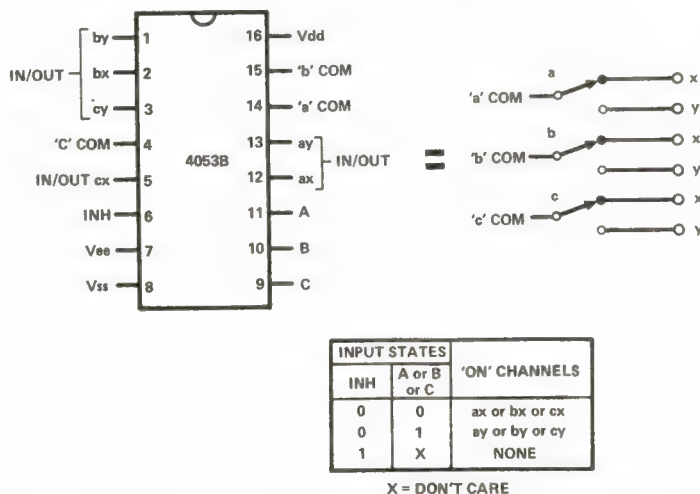
From the above description it can be seen that a CMOS 'n'-channel multiplexer can be regarded as a single-pole 'n'-way bilateral switch, and that a CMOS multiplexer can be converted into a demultiplexer by simply transposing the notations of the input and output terminals. An 'n'-way single-pole bilateral switch can thus be described as an 'n'-channel multiplexer/demultiplexer.

## Practical ICs

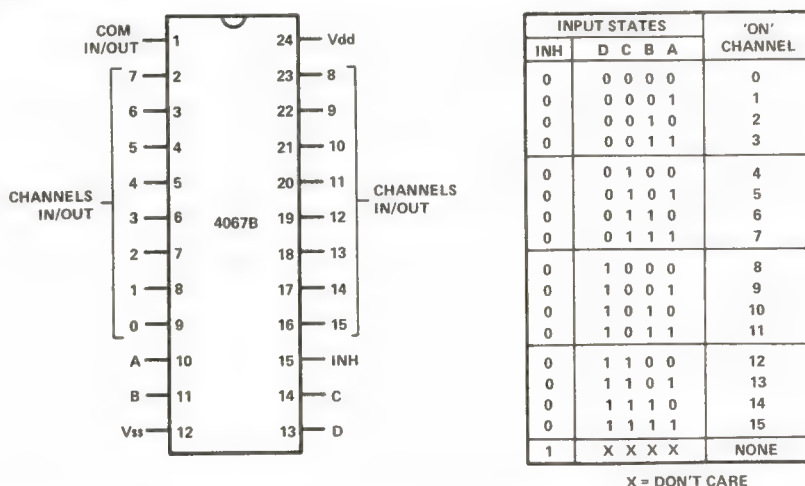
There are three major 'families' of CMOS bilateral-switch ICs. The best



**Fig 9** The 4052B differential 4-channel multiplexer/demultiplexer acts as a ganged 2-pole 4-way switch



**Fig 10** The 4053B triple 2-channel multiplexer/demultiplexer acts as three independent single-pole 2-way switches



**Fig 11** The 4067B 16-channel multiplexer/demultiplexer acts as a single-pole 16-way switch

known of these are the 4016B/4066B types. These are quad bilateral switches, each housing four independently-accessible SPST bilateral switches, as shown in Figure 7. The 4016B uses the simple form of construction shown in Figure 1, and is recommended for use in sample-

and-hold applications where low leakage impedance is of prime importance. The 4066B uses the improved type of construction of Figure 2, and is recommended for use in all applications where a low ON resistance is of prime importance.



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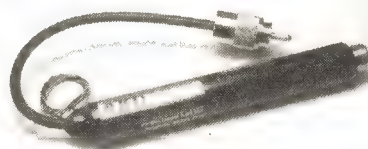
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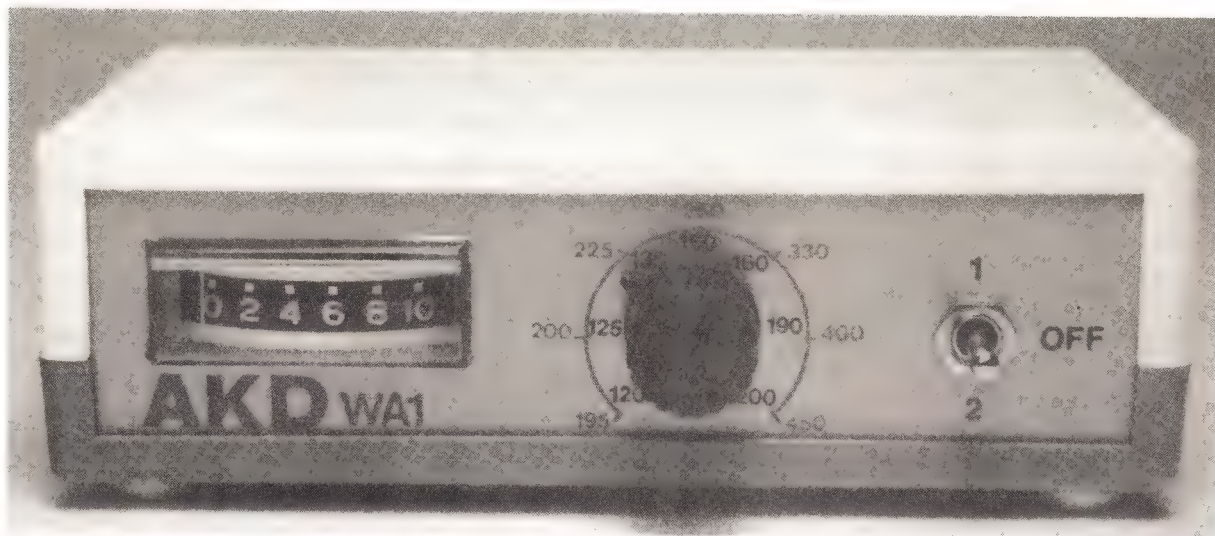


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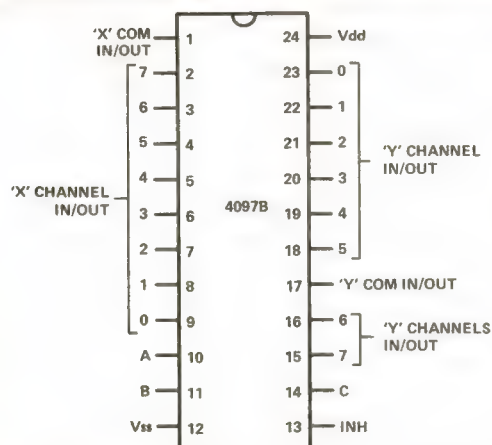
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INPUT STATES				SELECTED CHANNELS	
INH	C	B	A	X	Y
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	2	2
0	0	1	1	3	3
0	1	0	0	4	4
0	1	0	1	5	5
0	1	1	0	6	6
0	1	1	1	7	7
1	X	X	X	NONE	

X = DON'T CARE

The second family of ICs are the 4051B to 4053B types (Figures 8 to 10). These are multi-channel multiplexer/demultiplexer ICs featuring built-in logic-level conversion. These ICs have three 'power supply' terminals (VDD, VSS, and VEE). In all applications, VDD is taken to the positive supply rail, VSS is grounded, and all digital control signals (for channel-select, inhibit, etc) use these two terminals as their logic-reference values, i.e., logic-1 = VDD and logic-0 = VSS. In digital-signal processing applications, terminal VEE is grounded (tied to VSS). In analogue-signal processing applications, VEE must be taken to a negative supply rail; ideally,  $VEE = - (VDD)$ . In all cases, the VEE-to-VDD voltage must be limited to 18 volts maximum.

The 4051B (Figure 8) is an 8-channel multiplexer/demultiplexer, and can be regarded as a single-pole, 8-way bilateral switch. The IC has three binary control inputs (A, B, & C) and an INHIBIT input. The three binary signals select the one of the 8 channels to be turned on, as shown in the table.

The 4052 (Figure 9) is a differential 4-channel multiplexer/demultiplexer, and can be regarded as a ganged 2-pole, 4-way bilateral switch. It has two binary control inputs, which select the one of the 4 pairs of channels to be turned on, as shown.

The 4053B (Figure 10) is a triple 2-channel multiplexer/demultiplexer, and can be regarded as a set of three independently-accessible single-pole 3-way bilateral switches, each controlled via a single terminal (A, B, or C).

The final family of devices is the 4067B and 4097B multiplexer/demultiplexer types (Figures 11 and 12). These devices can be used in both analogue and digital applications, but do not feature built-in logic-level conversion. The 4067B is a 16-channel device, and can be regarded as a single-pole, 16-way bilateral switch. The 4097B is a differential 8-channel device, and can be regarded as a ganged 2-pole, 8-way bilateral switch. Each IC is housed in a 24-pin d.i.l package.

## USING 4016B/4066B ICs

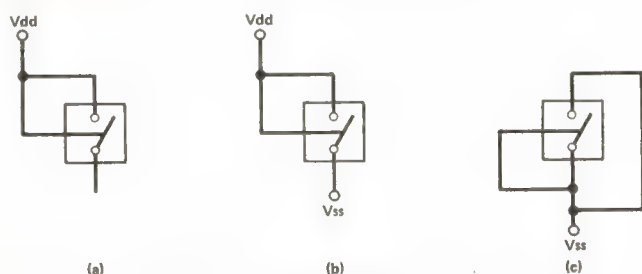
The 4016B and 4066B are very versatile ICs, but a few simple precautions must be taken when using them, as follows:-

(1). Input and switching signals must never be allowed to rise above VDD or below VSS.

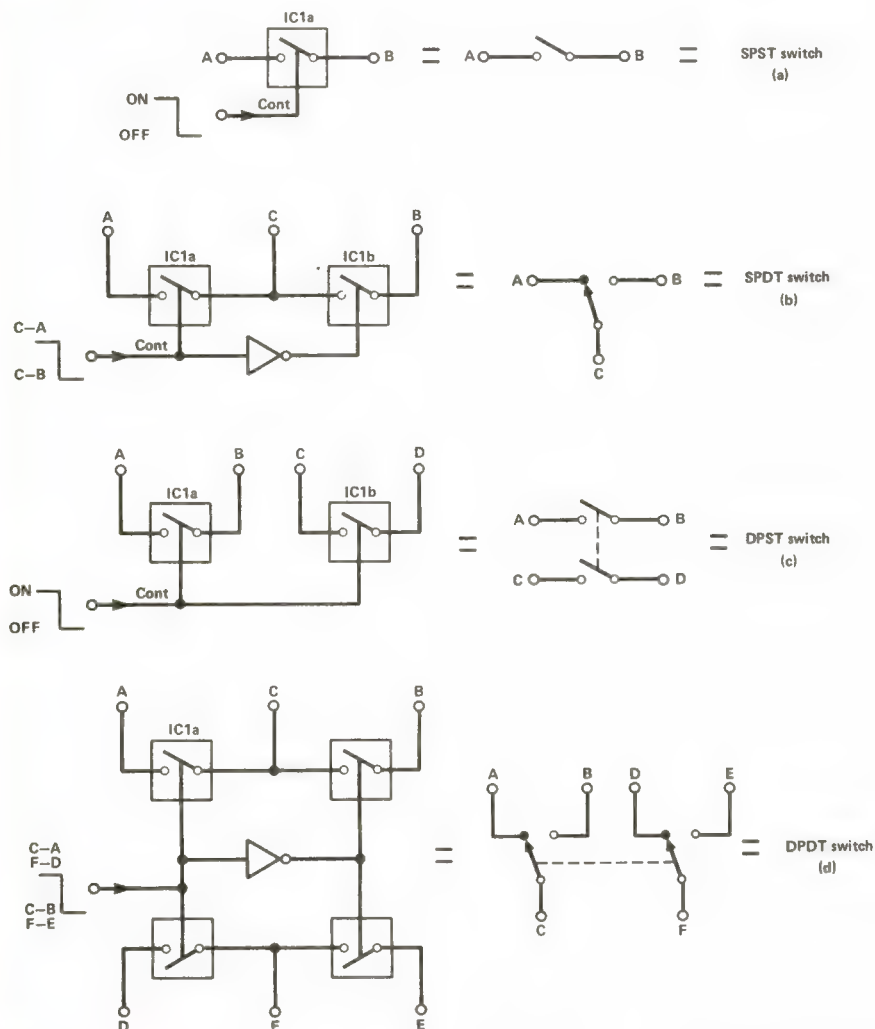
(2). Each unused section of the IC must be disabled (see Figure 13) either by taking its control terminal to VDD and wiring one of its switch terminals to VDD or VSS, or by taking all three terminals to VSS.

Figures 14 to 19 show some simple applications of the 4066B (or 4016B). Figure 14 shows the device used to implement the four basic switching functions of SPST, SPDT, DPST and DPDT. Figure 14a shows the SPST

**Fig 12** The 4097B differential 8-channel multiplexer/demultiplexer acts as a 2-pole ganged 8-way switch

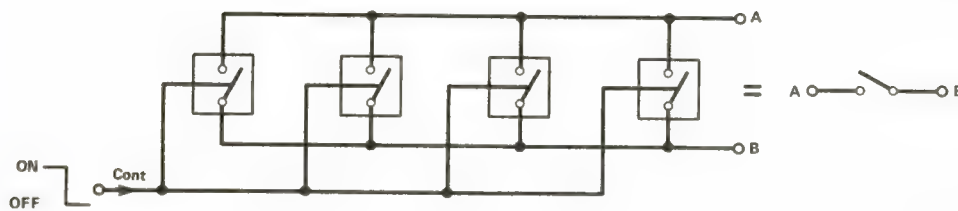


**Fig 13** Unused sections of the 4066B must be disabled, using any one of the connections shown here

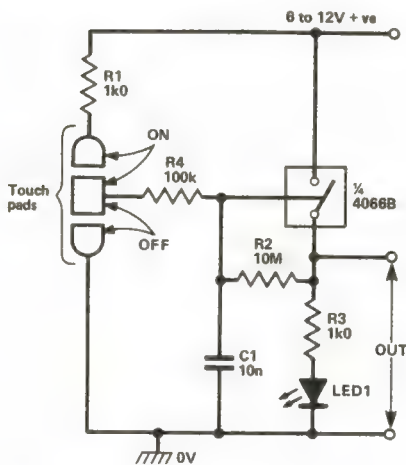


**Fig 14** Implementation of the four basic switching functions via the 4066B (IC1)





**Fig 15** This SPST switch has a typical ON resistance of only 22.5 ohms



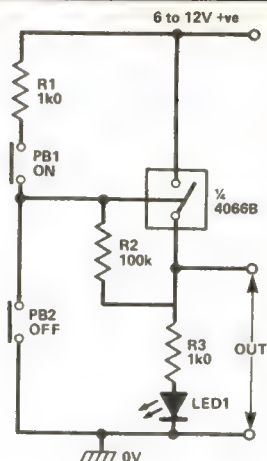
**Fig 17** Latching touch switch

connections, which we have already discussed. The SPDT function (Figure 14b) is implemented by wiring an inverter stage (a 4001B or 4011B, etc) between the IC1a and IC1b control terminals. The DPST switch (Figure 14c) is simply two SPST switches sharing a common control terminal, and the DPDT switch (Figure 14d) is two SPDT switches sharing an inverter stage in the control line.

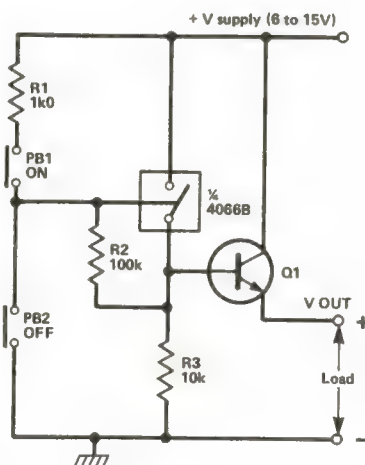
Note that the switching functions of Figure 14 can be expanded or combined in any desired way by using more IC stages. Thus, a 10-pole 2-way switch can be made by using five of the Figure 14d circuits with their control lines tied together.

Each 4066B bilateral switch has a typical ON resistance of about 90Ω. Figure 15 shows how four standard switch elements can be wired in parallel to make a single switch with a typical ON resistance of only 22.5 ohms.

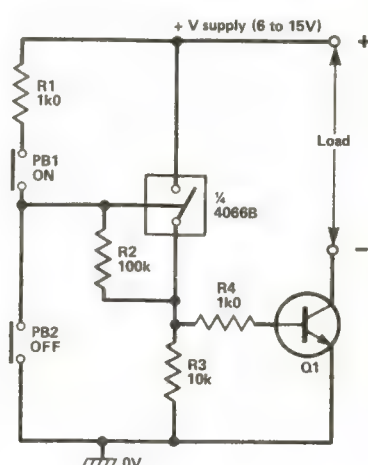
Figures 16 to 19 show ways of using a bilateral switch as a self-latching device. In these circuits, the switch current flows to ground via R3, and the control terminal is tied to the top of R3 via R2. Thus, in Figure 16, when PB1 is briefly closed the control terminal is pulled to the positive rail and the bilateral switch closes: with the bilateral switch closed, the top of R3 is at supply-line potential and, since the



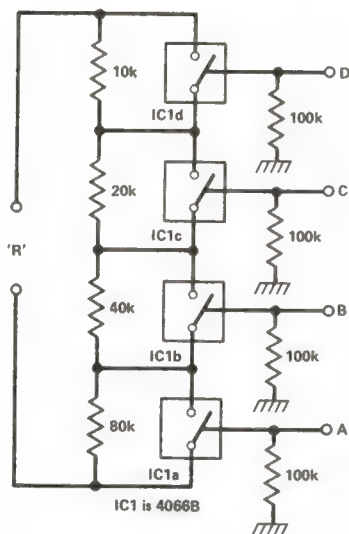
**Fig 16** Latching push-button switch



**Fig 18** Latching push-button power switch



**Fig 19** Alternative version of the latching power switch



**Fig 20** 16-step digital control of resistance. 'R' can be varied from zero to 150k in 10k steps

A	B	C	D	'R'
0	0	0	0	150k
0	0	0	1	140k
0	0	1	0	130k
0	0	1	1	120k
0	1	0	0	110k
0	1	0	1	100k
0	1	1	0	90k
0	1	1	1	80k
1	0	0	0	70k
1	0	0	1	60k
1	0	1	0	50k
1	0	1	1	40k
1	1	0	0	30k
1	1	0	1	20k
1	1	1	0	10k
1	1	1	1	0k

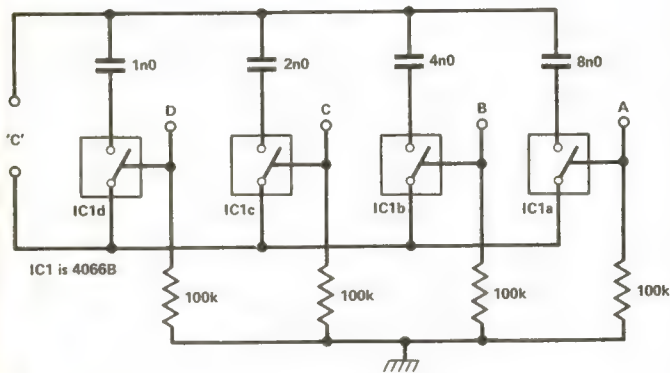
control terminal is tied to R3 via R2, the bilateral switch is consequently latched on. Once latched, the switch can only be turned off again by briefly closing PB2, at which point the bilateral switch opens and the R3 voltage falls to zero. Note in this circuit that LED1 merely indicates the state of the bilateral switch, and R1 prevents supply line shorts if PB1 and PB2 are both closed at the same time.

Figure 17 shows how the above circuit

can be made to operate as a latching touch-operated switch by increasing the value of R2 to 10M and using R4-C1 as a 'hum' filter.

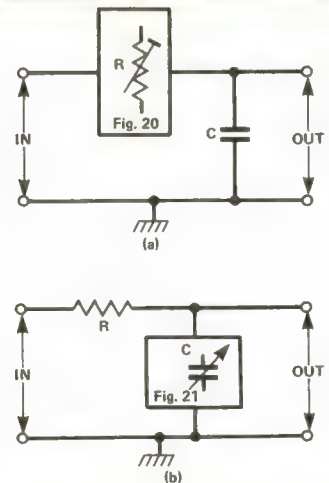
Figures 18 and 19 show alternative ways of using the Figure 16 circuit to connect power to external circuitry. The Figure 18 circuit connects the power via a voltage follower stage, and the Figure 19 design connects the power via a common-emitter amplifier.



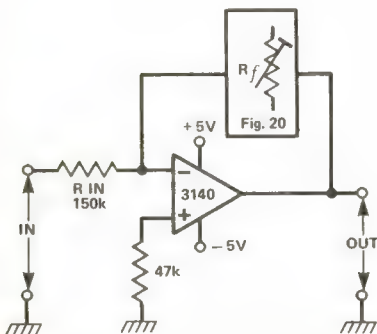


A	B	C	D	'C'
0	0	0	0	0
0	0	0	1	1n0
0	0	1	0	2n0
0	0	1	1	3n0
0	1	0	0	4n0
0	1	0	1	5n0
0	1	1	0	6n0
0	1	1	1	7n0
1	0	0	0	8n0
1	0	0	1	9n0
1	0	1	0	10n
1	0	1	1	11n
1	1	0	0	12n
1	1	0	1	13n
1	1	1	0	14n
1	1	1	1	15n

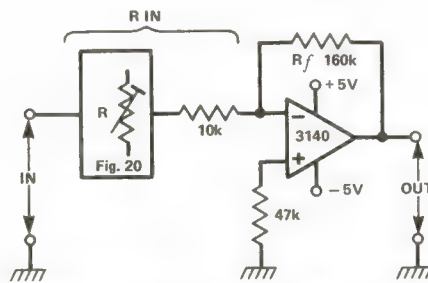
**Fig 21** 16-step digital control of capacitance. 'C' can be varied from zero to 15n in 1n0 steps



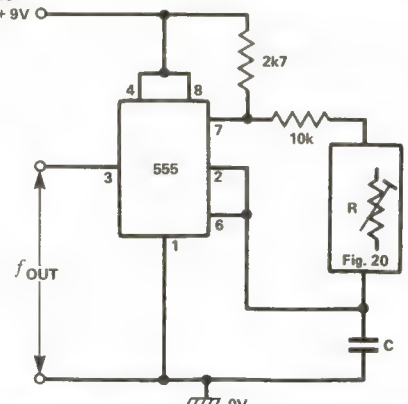
**Fig 22** Alternative ways of using Fig 20 or 21 to make a digitally-controlled 1st-order low-pass filter



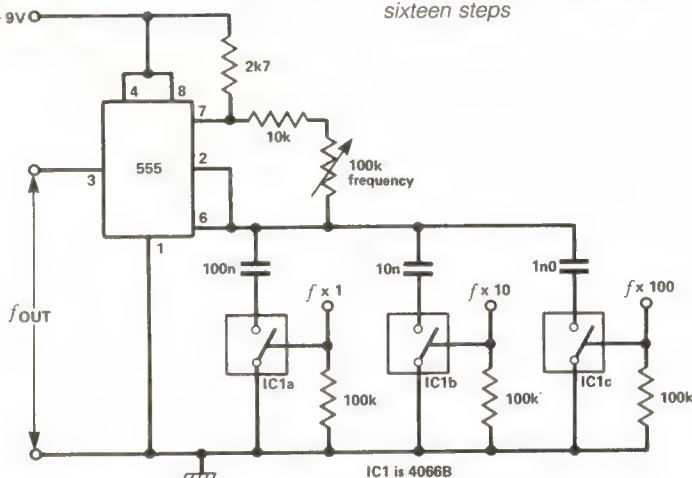
**Fig 23** Digital control of gain, using the Fig 20 circuit. Gain is variable from zero to unity in 16 steps



**Fig 24** Digital control of gain, using the Fig 20 circuit. Gain can be varied from unity to x16, in sixteen steps



**Fig 25** Digital control of 555 astable frequency, in sixteen steps



**Fig 26** Digital control of decade range selection of a 555 astable

## Digital control circuits

Bilateral switches can easily be used to digitally control or vary the effective values of resistance, capacitance, impedance, amplifier gain, oscillator frequency, etc, in any desired number of discrete steps. Figure 20 shows how the four switches of a single 4066B can be used to vary the effective value of a resistance in sixteen digitally-controlled steps of 10k each. In practice, the step magnitudes can be given any desired value (determined by the value of the smallest resistor) so long as the four resistors are kept in the ratio 1-2-4-8.

The number of 'steps' can be increased by adding more resistor/switch stages; thus, a six-stage circuit (with resistors in the ratio 1-2-4-8-16-32) will give resistance variation in 64 steps.

Figure 21 shows how four switches can be used to make a digitally-controlled capacitor that can be varied in sixteen steps of 1n0 each. Again, the circuit can be expanded to give more 'steps' by simply adding more stages.

Note in the Figures 20 and 21 circuits that the resistor/capacitor values can be controlled by operating the 4066B switches manually, or automatically via

simple logic networks, or by up/down counters, or via microprocessor control, etc.

The circuits of Figures 20 and 21 can be combined in a variety of ways to make digitally-controlled impedance and filter networks, etc. Figure 22, for example, shows two alternative ways of using them to make a digitally-controlled 1st-order low-pass filter.

Digital control of amplifier gain can be obtained by hooking the Figure 20 circuit into the feedback or input path of a standard op-amp inverting circuit, as shown in Figures 23 and 24. The gain of such a circuit equals  $R_f/R_{in}$ , where  $R_f$  is the feedback resistance and  $R_{in}$  is the input resistance. Thus, in Figure 23 the gain can be varied from zero to unity in sixteen steps of  $1/16$ th each, giving a sequence of 0,  $1/16$ ,  $2/16$ , etc, up to  $15/16$  and (finally)  $16/16$ .

In the Figure 24 circuit the gain can be varied from unity to x16 in sixteen steps, giving a gain sequence of 1, 2, 3, 4, 5, etc. Note in both of these circuits that the op-amp uses a split power supply, so the 4066B control voltage must switch between the negative and positive supply rails.

Figure 25 shows how the Figure 20 circuit can be used to vary the frequency of a 555 astable oscillator in sixteen discrete steps. Finally, Figure 26 shows how three bistable switches can be used



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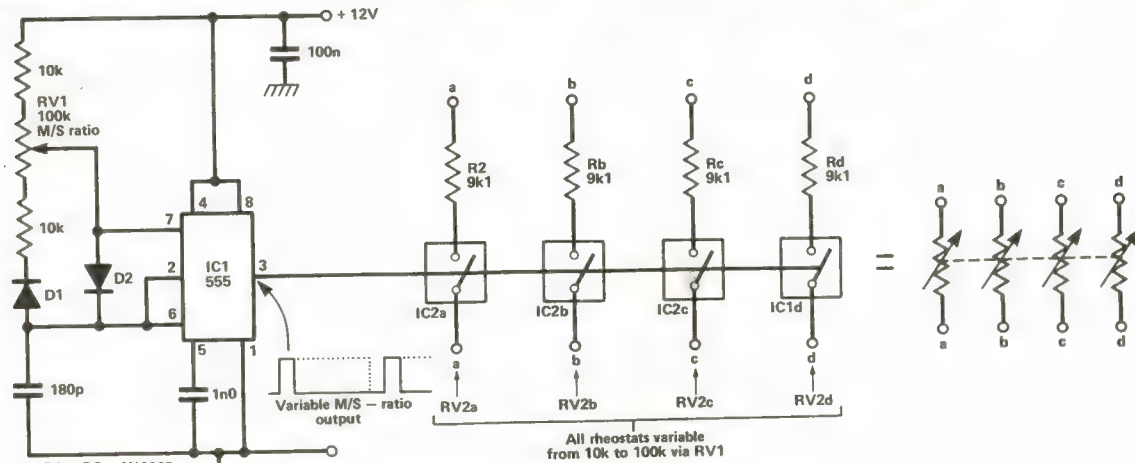
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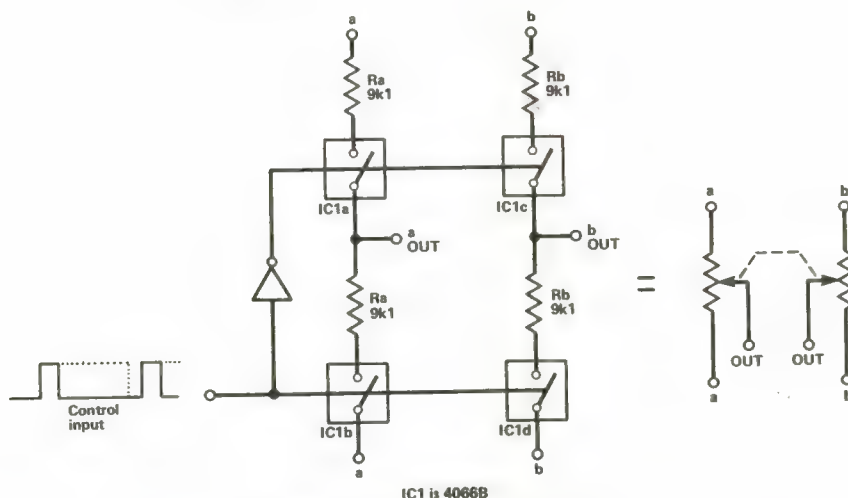
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**Fig 27** Synthesised precision 4-gang 'rheostat'



**Fig 28** Synthesised precision 2-gang 'pot'

to implement digital control of decade range selection of a 555 astable. Here, only one of the switches must be turned on at any time. Naturally, the circuits of *Figures 25 and 26* can easily be combined, to form a wide-range oscillator that can be digitally controlled by a micro, etc.

## Synthesised multi-gang pots, etc

One of the most useful applications of the bilateral switch is in synthesising multi-gang rheostats, pots, and variable capacitors in ac signal-processing applications. The synthesising principle is quite simple and is illustrated in *Figure 27*, which shows the circuit of a 4-gang 10k-to-100k rheostat for use at signal frequencies up to about 15 kHz.

Here, the 555 is used to generate a 50kHz rectangular waveform that has its mark/space ratio variable from 11:1 to 1:11 via RV1, and this wave-form is used to control the switching of the 4066B stages. All of the 4066B switches are fed with the same control waveform, and each switch is wired in series with a range resistor (Ra, Rb, etc), to form one gang of the 'rheostat' between the 'a' - 'a', 'b' - 'b', etc, terminals.

Remembering that the switching rate

of this circuit is very fast (50 kHz) relative to the intended maximum signal frequency (15 kHz), it can be seen that the MEAN or effective value of each 'rheostat' resistance can be varied via M/S-ratio control RV1. Thus, if IC2a is closed for 90% and open for 10% of each duty cycle (M/S-ratio = 9:1), the apparent (mean) value of the 'a' - 'a' resistance will be 10% greater than Ra, i.e., 10k. If the duty cycle is reduced to 50%, the apparent Ra value will double, to 18.2k. If the duty cycle is further decreased, so that IC2a is closed for only 10% of each duty cycle (M/S-ratio = 1:9), the apparent value of Ra will increase by a decade, to 91k. Thus, the apparent value of each gang of the 'rheostat' can be varied via RV1.

There are some important points to note about the above circuit. First, it can be given any desired number of 'gangs' by simply adding an appropriate number of switch stages and range resistors. Since all switches are controlled by the same M/S-ratio waveform, perfect tracking is automatically assured. Individual gangs can be given different ranges, without effecting the tracking, by giving them different range resistor values. The 'sweep' range and the 'law' of the

rheostat can be changed by altering the characteristics of the M/S-ratio generator. Finally, it must be noted that the control frequency of the M/S-ratio signal MUST be far higher than the maximum signal frequency that is to be handled, or the circuit will not perform correctly.

The 'rheostat' circuit of *Figure 27* can be made to function as a multi-gang variable capacitor by using ranging capacitors in place of the ranging resistors. In this case, however, the apparent capacitance value decreases as the duty cycle is decreased.

The *Figure 27* principle can be expanded, to make synthesised multi-gang pots, by using the basic technique shown in *Figure 28*.

Here in each gang, two 'rheostats' are wired in series but have their switch control signals fed in anti-phase, so that one rheostat value increases as the other decreases.

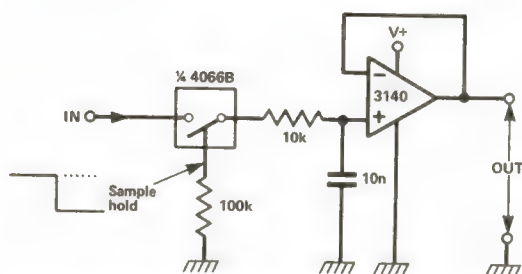
This basic circuit can be expanded, to incorporate any desired number of gangs, by simply adding more double-rheostat stages.

## Miscellaneous applications

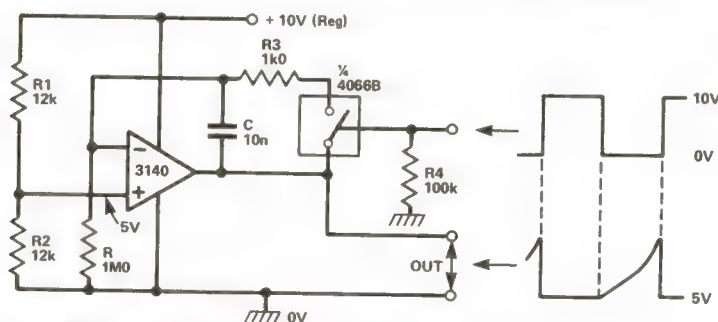
To complete this look at the CMOS bilateral switch, *Figures 29 and 30* show



## DATA FILE



**Fig 29** Using a bilateral switch as a sample-and-hold element



**Fig 30** Using the 4066B to implement a ramp generator circuit

a couple of 'miscellaneous' fast-switching applications of the device. Figure 29 shows how it can be used as a sample-and-hold element. The 3140 is used as a voltage follower and has a near-infinite

input impedance, just as the 4016B switch has a near-infinite impedance when open. Thus, when the 4016B switch is closed, the 10nF capacitor rapidly follows all variations in input voltage, but

when the switch opens the prevailing capacitance-charge is 'stored' and the resulting voltage remains available at the op-amp output.

Finally, Figure 30 shows a bilateral switch used in a linear ramp generator. Here, the op-amp is used as an integrator, with its non-inverting pin biased at 5 volts via R1-R2, so that a constant current of 5  $\mu$ A flows into the inverting pin via R. When the bilateral switch is open, this current linearly charges capacitor C, causing a rising ramp to appear at the op-amp output. When the bilateral switch closes, C is rapidly discharged via R3 and the output switches down to 5 volts.

The basic Figure 30 circuit is quite versatile. The switching can be activated automatically via a free-running oscillator or via a voltage-trigger circuit. Bias levels can be shifted by changing the R1-R2 values or can be switched automatically via another 4066B stage, enabling a variety of ramp waveform types to be generated.

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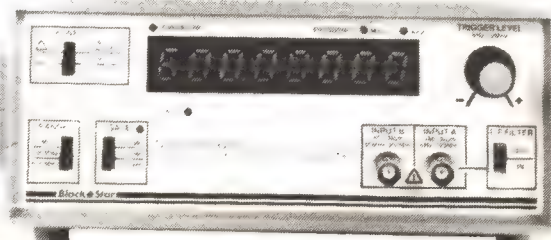
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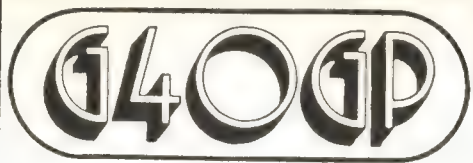
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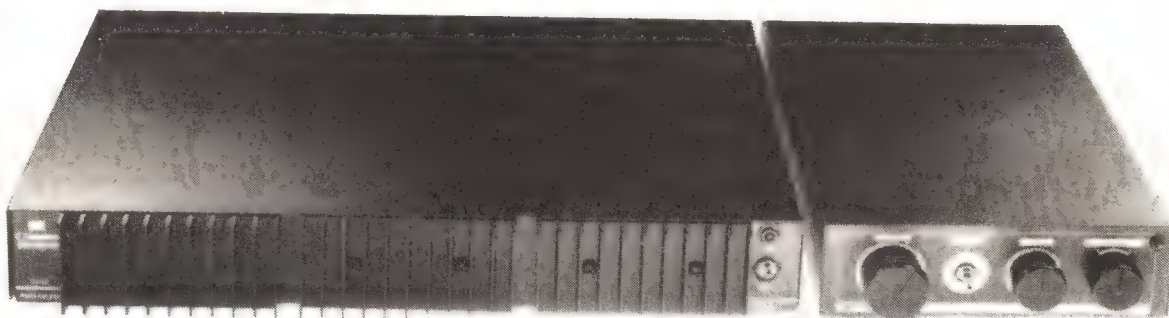
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## LISTENERS CHECK LIST

*Dial Search* (3rd edition) (Price £2.75) is designed as a guide for the home listener with a small portable radio, but it has proved popular with many expert hobbyists (DX-ers) and transmitting amateurs (hams).

The Dial-Search checklists serve as a chart. As well as your targets, they show the main landmarks and obstacles, and without these you cannot be sure precisely where you are on your small dial.

And like a landscape, it 'looks' different at different time of day or year, and as the weather changes. As evening sets in, we receive some stations much better for a few hours, others worse. Some reduce power. Some are closed down by 2200 hours. Some are only audible after midnight when stronger stations have gone off the air.

Thus Dial-Search saves you







## LATEST LITERATURE

hours of frustration and makes home listening really rewarding – as readers of previous editions have testified. This edition aims to save even more time, by indicating in its medium wave checklists the hours each station broadcasts and the period when (in SE England) it is worth searching for it.

Readers in the North, and on the continent of Europe, will also find a brief reference to the more powerful stations (on the fringes of our map) which they may expect to receive, though our portables here do not.

Whatever their location, all listeners can benefit from orienting their set (or aerial) towards the desired transmitter. Dial-Search has demonstrated how easy this can be, with the right map. This time our Europe map is larger and there is a map of Britain too.

Published by: George Wilcox,  
9 Thurrock Close, Eastbourne, Sussex BN20 9NF.

### MAIL ORDER CATALOGUE

A catalogue containing over 100 test and measuring instruments plus cables, connectors, kits and accessories is now available from Supercat Electronics.

This fully illustrated catalogue provides detailed electrical and mechanical specifications of all items mentioned and includes some handy reference tables.

Supercat Electronics Ltd, PO Box 201, St Albans, Herts. AL1 4EN.

### WIDE RANGE OF CIRCUIT BOARDS

BICC-Vero Electronics now has available its new circuit board catalogue which is claimed to contain the widest range offered by one manufacturer.

Of special note from the range of circuit boards offered are new eurocards, extender boards, the recently introduced Microbus euro-card backplane system, and the comprehensive range of microprocessor boards and backplanes. These include VME, S100, Motorola Exorsiser, Intel Multibus, STD bus and Apple.

The new catalogue, which has 40 full colour pages, details over 150 standard circuit boards plus a host of associated accessories such

as card handles, stand-offs, header and socket pins, pin insertion tools, spot face cutters and component carriers.

Hedge End Industrial Estate,  
Flanders Road, Hedge End,  
Southampton SO3 3LG  
Telephone: (04892) 81424/5.

### UPDATE ON STANDARD RANGE TRANSFORMERS

A leaflet available from Avel-Lindberg gives specification details including: primary voltages, nominal load, secondary volts and current, dimensions, weight, and mounting details for fifty 'Standard Range' power

transformers in a 15 to 130VA load rating.

Fifteen are provided with printed circuit style pins, ten with PCB pins and an extra wound screen, and twenty-five with flexible leads.

All the toroidal transformers are fully encapsulated in resin-filled thermoplastic cases which offer protection against mechanical damage and permit operation in hostile environmental conditions. They have the characteristics, inherent in toroidal construction, of an 8:1 lower radiated noise field, low volume, weight, and height profile, high efficiency and

low open circuit power. The leaflet also gives details of the various methods of connexion, performance details, and distributors.

Avel-Lindberg Limited, South Ockendon, Essex RM15 5TD.  
Tel: 070 885 3444.

### COMPATIBLE HIGHER-DEFINITION TELEVISION

A new volume – 'Compatible Higher-Definition Television' – has been published by the Independent Broadcasting Authority as the twenty-first in the series of occasional engineering texts that have been provided as a service to broadcast engineers and students since 1972.

This new 48-page book, with many two-colour illustrations, reflects recent interest in the development of television systems capable of providing significantly higher quality colour pictures than are possible on any of the present broadcast standards.

While a number of systems using more than 1000-lines per frame of picture definition and with an improved width-to-height ratio have been demonstrated, most of these would be incompatible with the hundreds of millions of existing 625-line or 525-line television receivers throughout the world.

In this book nine research engineers of the IBA and of Philips Research Laboratories discuss the requirements and technical problems still involved in enhancing television pictures seen in the home. They describe current work aimed at making this possible, including the use of low-cost digital processing in receivers in conjunction with an enhanced-MAC (multiplexed analogue component) satellite transmission system.

Contents: 'Introduction' by J B Sewter, IBA's Assistant Director of Engineering (Network and Development); 'Why non-compatible high-definition television?' by T J Long; 'Signal processing for higher-definition television' by G Tonge; 'Extended-definition MAC' by Dr M D Windram, R Morcom and T Hurley; 'Consumer displays for hi-fi television' by Dr C A A J Grebe, L J van de Polder and S L Tan.

Enquiries to IBA Engineering Information Service, Crawley Court, Winchester, SO21 2QA.  
Tel: Winchester (0962) 822444.







# AMATEUR RADIO

★ INSTANT HP FACILITIES ★ ACCESS ★ BARCLAYCARD ★ FREE FINANCE ★ MAIL ORDER

## YAESU

0010 FT1	Gen Cov HF 1'ceiver	PHONE
0020 Key T901	Curtis keyer for above	28.75
0030 DC11	DC power cable	10.35
0040 RAMT1	Non-volatile mem board	13.80
0050 FMU11	FM unit	42.85
0060 XF89KC	300Hz CW filter	18.40
0070 XF89KC	600Hz CW filter	18.40
0080 XF89KC	6kHz AM filter	18.40
0090 XF107KC	CW filter	16.65
0100 FT380	Gen cov HF 1'ceiver	PHONE
0110 SP980	Matching speaker	58.65
0120 FT102	9 band HF transceiver	PHONE
0130 FC102	9 band matching atu	179.00
0150 FV102DM	Remote vfo for above	230.00
0200 FM AM	External speaker	52.50
0240 MH1B8	Unit for above	46.75
0290 FT77	Scanning hand mic.	14.95
0450 Marker unit	8 band 100 watt 1'ceiver	PHONE
0460 FM unit		10.35
0410 FP100		27.20
0420 FC100	PSU for FT77	125.00
1449 FL100Z	ATU for FT77	98.30
0810 FT290R	160-10m linear amp	459.00
0840 FT390R	2m Multimode portable	269.00
0860 FC11C	70cm Multimode Portable	269.00
0880 C5C1A	FT290/790 AC charger	9.95
0870 MMB11	FT290/790 carrying case	4.20
0900 FL2010	FT290/790 Mob mount	26.85
0700 FT208R	290R Linear amplifier	63.25
0710 FT208R	2m FM handheld 21W	198.00
0750 NC9C	70cm FM handheld 1W	175.00
0720 FWB2	Slow charger	8.80
0740 FBA3	Spare Ni-cad battery pack	21.45
0760 NC7C	Charging sleeve	5.65
0770 NC8C	Base master charger	32.95
0780 PA3	Base master quick charger	54.05
0800 MMB10	Charger 12V DC	15.25
1000 FT238R	Mobile mounting bracket	8.05
1010 FT238R	2m 25W FM mob 1'ceiver	PHONE
1020 FT268R	70cms 10W FM mob 1'ceiver	229.00
1030 430T26	3 band all mode base station	PHONE
1050 40T26	70cms module	250.00
1051 41T26R	6 metre module	185.00
1060 41T26	HF module	200.00
1090 FRG7700	Full duplex x/band unit	55.00
1100 FRG7700M	0.2-30MHz gen cov rec	PHONE
1110 MEMGR7700	7700 with memory unit	69.00
1120 OCRG7700	Memory module	1.38
1130 FR17700	DC modification kit	46.00
1201 FRA7700	Antenna tuner unit	41.80
1140 F5	Active Antenna	10.75
1150 FRV7700A	Low pass filter	66.25
1160 FRV7700B	118-130, 130-140, 140-150MHz	90.85
1170 FRV7700C	118-130, 140-150, 50-59MHz	80.50
1180 FRV7700D	140-150, 150-160, 160-170MHz	87.40
1190 FRV7700E	118-130, 140-150, 70-80MHz	89.70
1200 FRV7700F	118-130, 140-150, 150-160MHz	89.70
0490 FT750GX	118-130, 150-160, 170-180MHz	PHONE
	Multi Mode Gen Cov	

## ICOM

IC751	* NEW * 100W H.F.	PHONE
IC745	* NEW * 100W H.F.	PHONE
RC10	Keyboard Freq. cont.	PHONE
PSU(int)	230v AC power supply	149.00
FMEX2421	FM module for above	32.50
KEYEREX2431	Keyer module for above	20.00
IC730	100W HF trans 12V DC	659.00
FL20	SSB pass band filter	29.00
IC720A	100W HF trans plus gen. cov.	989.00
PS15	230v p.s.u. for HF 1'ceivers	119.00
PS20	230v chopper type unit	195.00
FL45	500kHz filter for 740/730	38.00
FL44	2.4kHz SSB filter	79.00
FL32	CW narrow filter for 720	39.00
FL34	AM filter for 720	29.00
EX202	LDA unit for 730	13.50
EX203	CW audio filter for 730	14.50
EX205	TRV unit for 730	14.00
IL10	Memory back up for 720	5.95
IC2KL + PSU	500W solid state linear	1303.33
AT100	100 watt HF Auto ATU	269.00
AT500	500 watt HF Auto ATU	369.00
CF1	Cooling fan	24.00
SP3	Matching ext speaker	45.00
HP1	Communication phones	34.50
SMS	Base microphone	34.50
IC-R70	Comms rec 230v AC	549.00
FM unit	Plug in module	30.00
FL63	CW narrow filter	39.00
FL44	Xtal filter	79.00
IC250H	Multimode 2m 12v DC	469.00
BU1	Back up supply	24.50
IC471	Multimode 70cm	699.00

## ICOM CONT.

2450 IC490	Multimode 70cm 12v DC	495.00
2480 IC2E	2m synth h/held 1.5w Special	169.00
2490 IC4E	70cm synth h/held 1.5w	219.00
2475 IC2E	144MHz h/held with k/b + LCD	229.00
2476 IC4E	432MHz h/held with k/b + LCD	T.B.A.
2810 MMB10	Mobile mounting bracket	12.50
2840 MMB12	Mobile mounting bracket	12.50
2870 HM7	8 pin hand mic.	14.95
2880 HM9	L/S mic for IC2E/4E	16.50
2900 HM10	Up/down scan mic.	29.00
2950 SM2	4 pin desk mic.	34.50
2960 SM5	8 pin desk mic.	34.50
2962 SM6	Desk mic (745/751/271/471)	34.50
2970 SP3	External loudspeaker	45.00
2520 LC3	Cases for IC2E/4E	5.00
2570 BC25	Standard mains charger	6.69
2590 BC30	Base hnd type charger	56.35
2610 BP2	Low voltage pack	38.00
2620 BP3	Standard pack	25.00
2630 BP4	Empty battery box (AA cells)	7.95
2640 BPS	High power battery pack	48.00
2650 CP1	Charger lead for 12V supply	4.95
2660 DC1	12v Regulator pack	9.75

## TRIO/KENWOOD

1450 TS300S	160-10m 1'ceiver with gen cov	1095.00
1460 AT300	Automatic ATU 80-10m	141.75
1470 SP300	External speaker unit	98.00
1490 YK88A-1	6kHz AM filter	33.25
1500 YK88C-1	500Hz CW filter	33.25
1510 YG455C-1	500Hz CW filter	77.50
1520 YG455C-1	270Hz CW filter	91.75
1530 TS430S	160-10m with gen cov rec	736.00
1540 PS430	Mains PSU for TS430S	112.75
1550 SP430	Speaker for TS430S	28.50
1570 FM430	FM option unit TS430S	34.50
1580 YK88C	500Hz CW filter	31.75
1590 YK88CN	270Hz CW filter	37.25
1600 YK88SN	1.8kHz SSB filter	32.50
1850 TL32	160-10m 2kw linear	724.50
1870 MC60 N4	Desk microphone	51.50
1880 MC60 S6	Desk mic with up/down	53.50
1890 MC60A	Desk mic with pre-amp	55.25
1900 MC35S	Fist microphone 500ohm imp	14.75
1910 MC30S	Up/down mic for TR9000/7800	14.75
1920 MC40S	Up/down mic (TS930S)	15.25
1930 MC42S	LF low pass filter	21.25
1940 LF30A	2m/70cm all mode 1'ceiver	765.00
1950 TS780	2m multi mode mobile	433.50
1980 TR9130	FM transceiver 2m/70cm	425.00
1934 TW4000	2m FM synth handheld	219.00
1680 TR2500	Base stand and charger	51.75
1700 ST2	Soft case and belt hook	13.75
1710 SC4	Desk mic and power unit	31.75
1720 MS1	Speaker/microphone	18.80
1730 SMC25	Deluxe leather case	24.00
1750 LH2	Power supply from 12V	16.00
1770 DC25	70cm handheld trans.	225.00
1780 TR3500	70cm multimode mob.	395.00
1790 TR3500	Gen cov rec 150kHz-30MHz	239.00
1800 R600	Gen cov rec	389.00
1820 RC10	World time clock	62.00

## DATONG

3880 PC1	Gen cov converter	137.40
3870 VLF	Very low frequency converter	29.50
3670 ANF	Freq agile audio filter	67.85
3660 FL2	Multi-mode audio filter	89.70
3650 RL3	Auto filter for receivers	129.00
3700 ASP/B	r.f. speech clipper for Trio	82.80
3700 ASP/A	r.f. speech clipper for Yaesu	82.80
3710 DT5	Manual RF speech clipper	56.35
3740 OT0	Morse Tutor	56.35
3750 MK	Keyboard morse sender	137.40
3910 RFA	RF switched pre-amp	33.50
3800 AD270	Active dipole indoor	47.15
3820 AD370	Active dipole outdoor	64.40
3810 AD270-MPU	As above with mains p.s.u.	51.75
3830 AD370-MPU	As above with mains p.s.u.	69.00
3990 MPU	Mains power unit	6.90
3730 RFC/M	RF speech clipper module	29.90
3920 PTS1	Tone squelch unit	46.00
3640 SRB2	Auto Woodpecker blanker	86.25

## MICROWAVE MODULES RANGE

3130 MML28/100-S	10m 100W lin/preamp	129.95
3140 MML70/50	4m 50 watt lin/preamp	85.00
3150 MML70/100-S	4m 100W lin/preamp	139.95
3160 MML144/30S	2m 30W linear amp	69.95
3170 MML144/100-S	2m 50W lin/preamp	85.00
3180 MML144/100S	2m 100W (1 or 3W i/p)	139.95
3190 MML432/30L	70cm 30W lin/preamp	99.00
3200 MML432/50	70cm 50W lin/preamp	109.95
3210 MML432/100	70cm 100 watt linear	228.65
3220 MML432/50	70cm ATU con, VHF out	37.90
3250 MMC435/51	70cm ATU con, UHF out	27.90
3260 MMC435/600	70cm ATU 20W t'mitter	149.00
3270 MTV435	Converter with keyboard	99.95
3280 MM1000KB	RTTY to TV converter	189.00
3300 MM2001	RTTY term with keyboard	299.00
3320 MM4001KB	The MORSETALKER	115.00
3330 MM51	Advanced morse trainer	109.00
3340 MMS2	10m linear transverter	109.95
3350 MMT28/144	4m linear transverter	119.95
3360 MMT70/28	4m linear transverter	109.95
3370 MMT70/144	70cm linear transverter	159.95
3380 MMT144/28	70 cm linear transverter	184.00
3390 MMT432/28-S	23cm linear transverter	184.00
3400 MMT1236/14-R	27MHz to med wave conv	19.95
3410 MMT1236/14-R	10m to 2m up conv	29.90
3425 MMT27/MW	8m to 10m down conv	29.90
3430 MMT28/144	4m to 10m down conv	32.90
3440 MMT50/28	2m to 10m down conv	29.90
3450 MMT70/28	2m to 10m down conv	32.90
3460 MMT70/28L0	2m to 10m down conv	32.90
3470 MMT144/28L0	70cm to 2m down conv	37.90
3480 MMT432/28-S	70cm to 2m down conv	37.90
3500 MMT432/144-S	23cm to 2m down conv	34.90
3510 MMT1236/28	23cm to 2m down conv	69.95
3520 MMT1236/144	1691MHz Meteosat conv	129.95
3530 MMT1691/1375	10m low noise preamp	16.95
3540 MMTA28	2m RF switched preamp	34.90
3550 MMTA144V	23cm low noise preamp	75.00
3560 MMTA129	500MHz digital freq meter	29.90
3570 MMT6000/500	600MHz-10 precaler	14.90
3580 MMT6000P	Freq counter amp/probe	29.90
3590 MMTD1P	384MHz freq source	11.90
3600 MMT384	15dB, 10W attenuator	
3630 MMR15/10		

## AZDEN

4060 PCS4000	2mFM transceiver 25W	229.00
4130 MEX55	Mobile boom safety mic	28.50

## FDK

5779 M750XX	2m FM/SSB/CW 10W 1'ceiver	315.00
5782 EXP 430	M.750 70cm transverter	249.00
5772 KP100	AC/DC Electronic Keyer	69.00
5780 ATC720	Synth air monitor 110-138MHz	159.00
5781 RX40	Synth FM mon 140-180MHz	149.00

## MUTEK LTD

5850 SLNA 50s	50MHz low noise switched preamplifier using BF981	37.10
5860 SLNA 70s	70MHz low noise switched preamplifier using BF981	37.10
5870 SLNA 70u	70MHz low noise unswitched preamplifier using BF981	22.40
5880 SLNA 70ub	Unboxed version of SLNA 70u	13.70
5890 SLNA 144s	144MHz low noise switched preamplifier using BF981 (0.9dB noise figure)	37.10
5900 SLNA 144u	144MHz low noise unswitched preamplifier using BF981	27.40
5910 SLNA 144ub	Unboxed version of SLNA 144u	13.70
5920 SLNA 145ub	Transceiver optimised preamplifier with antenna c/o switching using BF981. Intended for the FT290R, but has many other applications! Ultra-high performance environmentally housed switched gasfet preamplifier using advanced negative feedback circuitry for superb dynamic performance. Supplied with ATCS 144c controller	129.95
5940 TLNA 432s	Very high performance bipolar transistor switched preamplifier for 430-440MHz using BF069 for 1.4dBnF and 0dBm input intercept performance	74.90
5950 TLNA 432u	Unswitched boxed variant of TLNA 432s	29.00
5960 TLNA 432ub	Unboxed TLNA 432u	28.40
5970 GLNA 432u	Series 432 MHz gasfet unswitched preamplifiers	PHONE
5980 BLNA 432ub	Sub-miniature 1.3dBnF BF069 preamplifier	13.70

## MUTEK LTD

5890 BLNA 129ub	Noise r	
6000 RPB 144ub	Comple	
6010 RPB 251ub	Comple	
6020 HDRA 95u-1	1.5dBn	
6030 HDRA 95u-2	11.5dB	
6040 BBBA 500u	20-500	
6050 BBBA 850u	250-850	
6060 XBP 700ub	Microst	
6070 PPSU 012	12V (inc	
6080 CISA 001	'UHF' (r	
6090 ATCS 144s	Transm	

## WRAASE ELECT

4720 SC140	SSV	
4730 SC160	SSV	
4740 SC42A	SSV	
4775 SC-1	SSV	
4750 FG422A	Light	
4760 KB422A	Keyba	
4780 Prince	12" gr	

## SCANNING REC

5573 Sony ICF7600D	Digital	
5574 Power supply mains, f		
5580 Bearcat BC100	synthe	
5510 Bearcat BC200FB	AM	
5650 JH SX200N AM/FM V		
5651 JH SX400 26-510MHz		
5659 Gemscan Synthesised		
5641 AOR2001 Synth. 26-52		
5770 Fairmate AS32320 AM	airband	
5780 Corona CD6000 AM ai		
5781 FDK RX40 pocket synt		
5780 FDK ATC720 pocket sy	receiver	

## VHF/UHF AMPL

TONO PRODUCTS		
5340	2M-50W	40W i/p
5350	2M-100W	90W i/p
5360	MR-150W	140W i/p
5370	MR-250W	210W i/p
5380	MR28	100W i/p
5390	4M60	50W i/p
TOKYO HY-POWER LABS		
5670	HC-150	3.5MHz
5680	HC2000	1.8MHz
5690	HL-82V	2M line includes I/P
5700	HL-160V	2M line includes I/P
5709	HL-45U	70cm i/p 50W Q
5711	HL90U	70cm i/p Q/P



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AVAILABLE ON ALL LISTED ITEMS ★ RAPID DESPATCH ★ PART EXCHANGE ★

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5440 HK704	Up/down super deluxe	17.65
5450 HK705	Up/down deluxe	13.80
5460 HK706	Up/down economy	14.60
5461 HK707	Up/down popular	13.75
5470 HK708	Basic unit up/down	13.26
5480 MK704	Squeeze keyer manipulator	12.65
5490 MK705	As 0548 with metal base	21.28
5501	Ex-ministry No. 8 key, original packing	4.95

### Benchner Products

5220 BY1	Keyer paddle (black base)	37.95
5230 BY2	Keyer paddle (chrome base)	48.30
5240 BY3	Keyer paddle (gold plated)	92.00
5250 ZA1A	Balun 3.5-30MHz for dipoles	15.00
5260 ZA2A	Balun 14-30MHz for beam antennas	17.25

## RTTY/CW READERS

### Tasco Products

5400 CWR685E	Tele reader - RTTY/CW/ASCII	768.00
5410 CWR670	Tele reader - as above, RX only	349.00
5420 CWR610E	Tele reader - as above, basic unit	159.00

### Tono Products

5270 9000E	CW/RTTY/ASCII/Editor/lite pen, term L	669.00
5280 560E	CW/RTTY/ASCII/Terminal RX	299.00
5290 350	CW/RTTY/ASCII/Terminal RX only	259.00
5300 CRT120G	VDU 12 inch green screen - mains power	125.00
5310 CRT1200G	VDU 12 inch for 80 columns	136.00
5320 HC800	Line printer centronics	449.00
5330 SK7	Plug adaptors for printers	8.90

### ICS Electronics

4900 AMT-1	Amtror RX/TX	265.00
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## BNOS ELECTRONICS

5800 12/6A	Power supply 13.8V 6 amp, fully protected	48.30
5810 12/12A	Power supply 13.8V 12 amp, fully protected	86.40
5820 12/24A	Power supply 13.8V 25 amp, fully protected	125.45
5830 12/40A	Power supply 13.8V 40 amp, fully protected	225.40
5831 L144/1/100	1 watt input linear	138.00
5832 L144/3/100	3 watt input linear	138.00
5833 L144/10/100	10 watt input linear	115.00
5834 LPM144/1/100	1 watt input linear/preamp	172.50
5835 LPM144/3/100	3 watt input linear/preamp	149.50
5836 LPM144/10/100	10 watt input linear/preamp	155.00
5837 L144/25/180	25 watt input linear	189.50
5838 LPM144/25/180	25 watt input linear/preamp	178.00
5839 L144/10/180	10 watt input linear	212.50
5840 LPM144/10/180	25 watt input linear/preamp	

## TONNA ANTENNAS F9FT

50MHz	L(M)	W(kg)	
6100 5 element	3.5	3.2	34.30
144MHz			
6103 4 element	0.87	0.5	14.95
6110 9 ele fixed	3.3	1.9	17.71
6120 9 ele portable	3.3	1.7	20.00
6130 9 ele crossed	3.5	2.0	32.43
6140 13 ele portable	4.5	2.5	31.05
6150 17 ele fixed	6.60	4.5	37.86
435MHz			
6190 19 element	3.2	1.1	20.70
6189 19 ele crossed	3.3	1.8	34.27
6200 21 element	4.6	2.6	29.62
6210 21 element ATV	4.6	2.6	29.67
144/435MHz			
Oscar Special			
6160 9 & 19 element	3.3	2.0	34.27
1.250MHz or 1.296MHz			
6213 23 element	1.8	0.9	25.90
6214 4 x 23 ele antennas - power splitter - stacking frame			148.00

Full range of J Beam, T.E.T. and Yaesu antennas available!

## WELZ

4980 SP200	1.8-160MHz PWR/SWR	88.95
4990 SP300	1.8-500MHz PWR/SWR	97.00
5000 SP400	130-500MHz PWR/SWR	88.95
5010 SP600	1.8-500MHz PWR/SWR	97.00
5040 SP10X	1.8-150MHz PWR/SWR	24.45
5020 SP15M	1.8-160MHz PWR/SWR	35.00
5030 SP45M	130-470MHz PWR/SWR	51.00
5050 SP250	1.8-600MHz PWR/SWR	49.50
5060 SP350	1.8-500MHz PWR/SWR	58.95
5080 AC38	3.5-30MHz ATU 400w PEP	65.00
5160 TP65X	50-500MHz 0-5W meter	13.95
5131 CA35A	Static protector	10.75
5132 CA23N	Static protector	12.80
5090 CT15A	15/50W dummy load PL259	7.95
5100 CT18N	15/20W dummy load N plug	13.95
5110 CT150	150/400W dummy load	35.50
5120 CT300	300/1kW dummy load	49.50
5130 CT03N	3W dummy load 1.3ghz	30.00
5140 CH20A	2 way coax switch SO239	17.95
5150 CH20N	2 way coax switch N socket	31.95
5133 DF72C	144/430MHz duplexer	19.95

## A.R.E. SPECIALS - OUR OWN IMPORTS

### ALINCO VHF/UHF AMPLIFIERS

5720	2m linear 30W O/P 1-3W I/P	49.00
5730	70cm linear 10W O/P 1-3W	59.00
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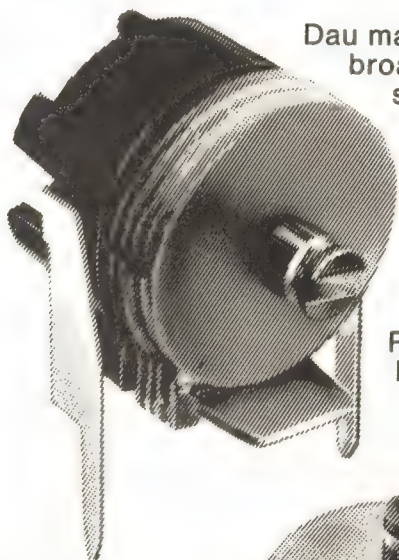
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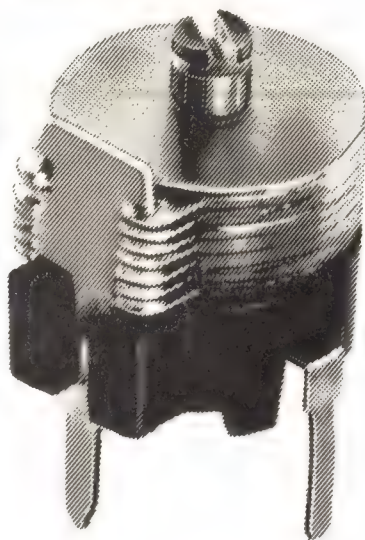
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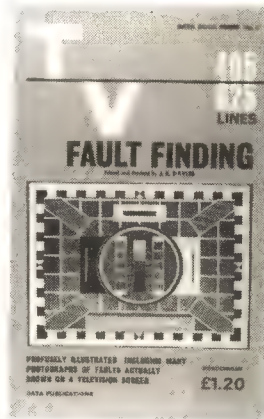
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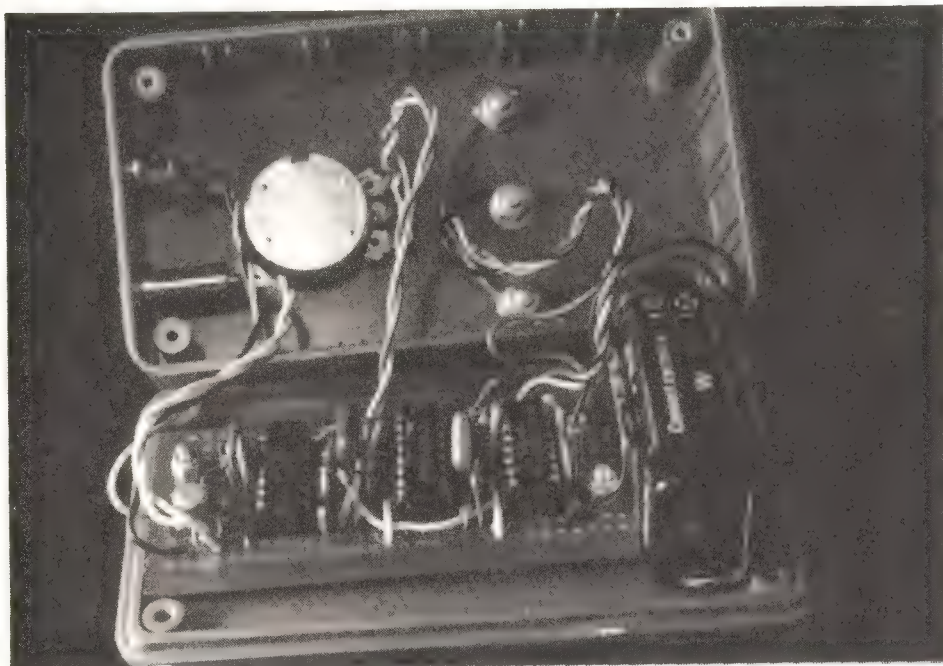


# THE PIANO KEYER

**For around a fiver you too can play perfect morse! G D Wilson, GM3NUF, describes how this can be done**



*The piano keyer in use*



**General view:** in upper part of box, two output jacks, RV1, three key connections. Circuit board (left to right) TR1, IC3, IC2, IC1

The decision to develop and construct a fully automatic keyer was forced upon me after unsuccessfully trying to master a complicated semi-automatic bug key. This super-deluxe keyer cost nearly a week's pay (it was on loan, need I say!) It required several carefully set-up adjustments and it defeated my careful efforts to send correctly timed and spaced dots and dashes. One look at this chrome-plated 'mechanic's delight', (beautiful – but Heath Robinsonish), and it was immediately obvious that, with ICs at a few pence apiece, a cheaper and easier way to send perfect code would be possible.

## Requirements

The main criteria for the new electronic keyer were:-

1. Self-completing dots, dashes and spaces, thus allowing one to send perfect code with an effortless and sloppy action!
2. Speed to be continuously operator-adjustable from about 10 to 30 words per minute.
3. Mechanically simple, i.e. no awkward paddle to construct with its attendant pivot, adjustable stops and tension springs.
4. Compatibility with positive keying line transmitters, but with the possibility of easy modification to relay keying and interfacing with any transmitter.
- 5 Side-tone monitor. Although most modern transmitters have side-tone monitoring, this facility on the keyer allows it to be used for practice purposes.

Of the above points, the mechanical keying arrangements gave the most cause for head-scratching, though the final solution is delightfully simple. Several simplified forms of paddle were considered, some using lever operated microswitches. However, by chance I was led to try touch-sensitive switches with such promising results that further attempts to construct a suitable paddle were abandoned. The touch-sensitive keys are very positive and keying is effortless at high speeds. The downwards pressure keying operation elimin-



# PIANO KEYS

ates any tendency for the keyer to 'walk' across the table. Although the operation is very different from the old pump-handle brass-pounder, and the conventional bug key, only a few hours practice are necessary for keying to become almost instinctive.

## Additional features

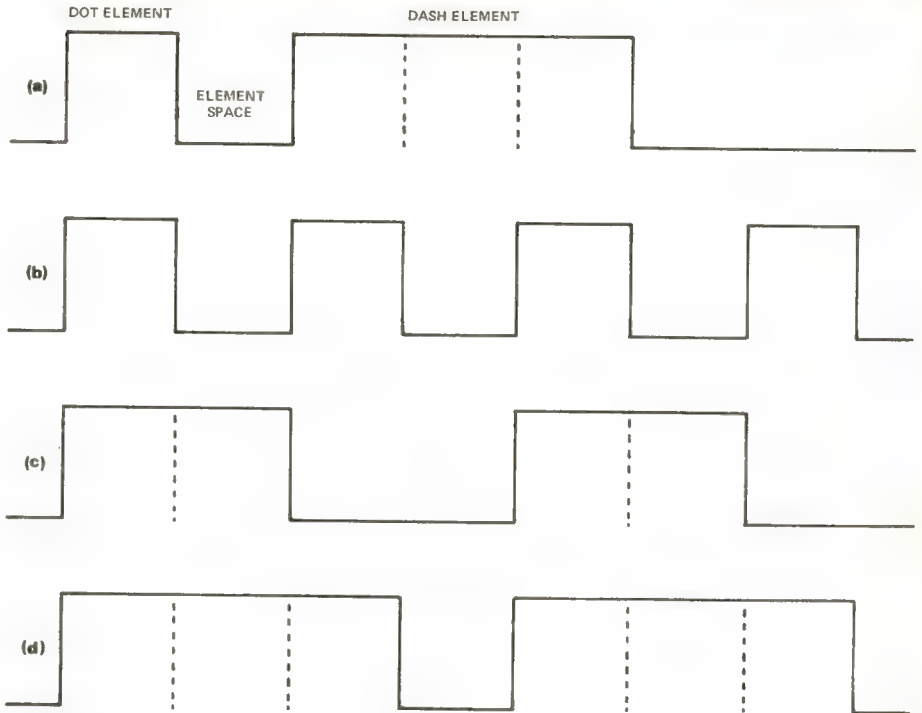
As well as the initial criteria the following advantageous features were also achieved:-

1. Electronically simple, - only 3 ICs and one transistor are the active devices.
2. Low power consumption - about 0.5mA when keying. No standby drain, no ON/OFF switch required.
3. Mechanically simple - no moving parts.
4. Pocket size and light weight. Ideal portability.
5. Low cost - about a fiver should cover it, assuming that you have a few bits and pieces in your junk box.

## Morse code generation

The Morse Code timing is such that dot elements and element spaces are equal, and dash elements are equal to three dot elements, see Figure 1. A string of dots can be produced by a multivibrator (MVB) that has a 1:1 mark/space ratio. A string of dashes is more difficult as it must have a 3:1 mark/space ratio.

Some early electronic keyer circuits used two multivibrators with a ganged

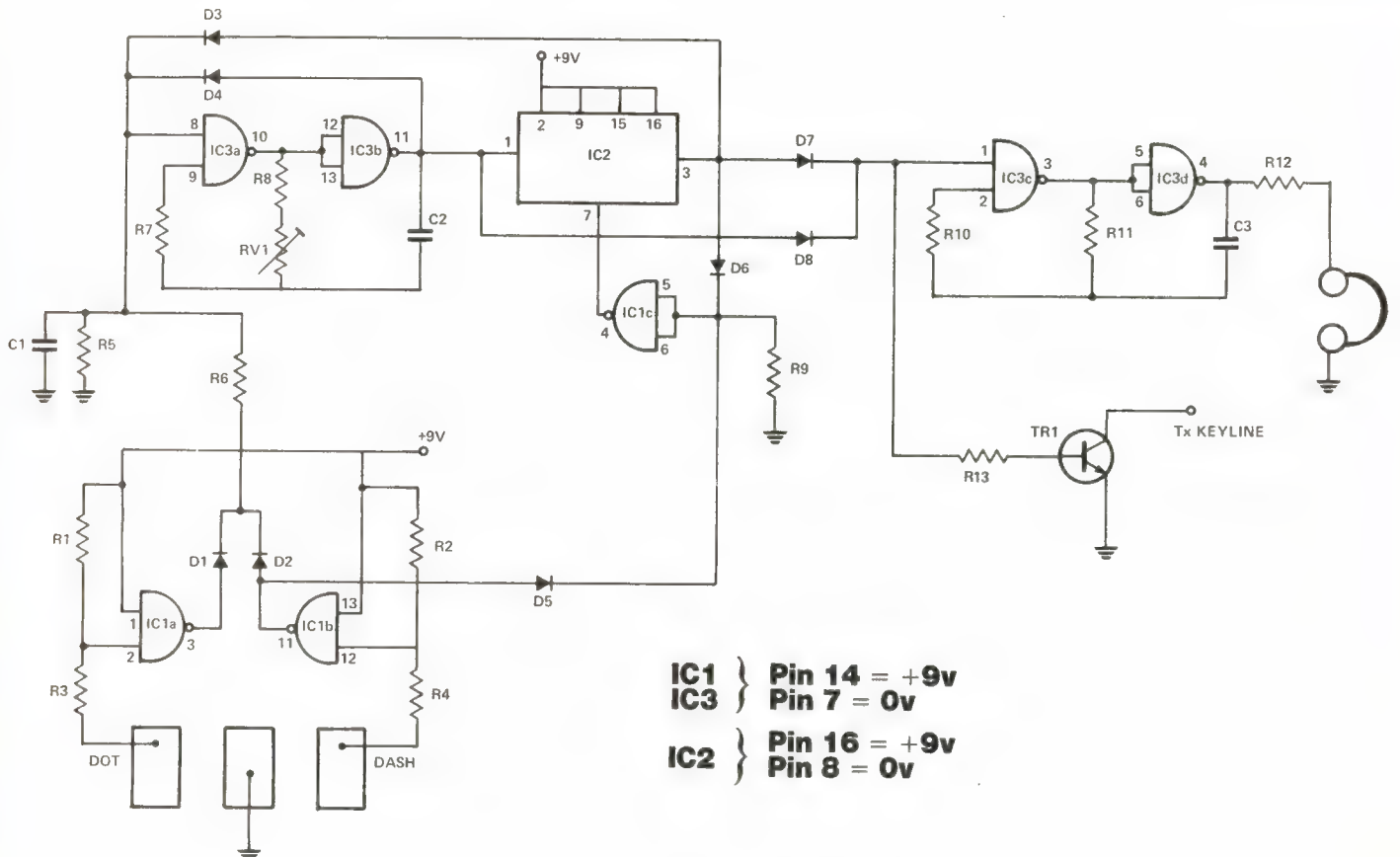


**Fig 1** Morse code generation **a)** Dot and dash timing **b)** Dot MVB output **c)** Divider output **d)** b+c = dashes

speed control, but apart from the problems of achieving accurate tracking of both speed and mark/space ratio over the speed range, the transitional ele-

ment space when going from dot to dash, or vice-versa, was entirely dependent on the speed of the operator.

One soon arrives at the conclusion that



**Fig 2** The circuit diagram



# PIANO KEYER

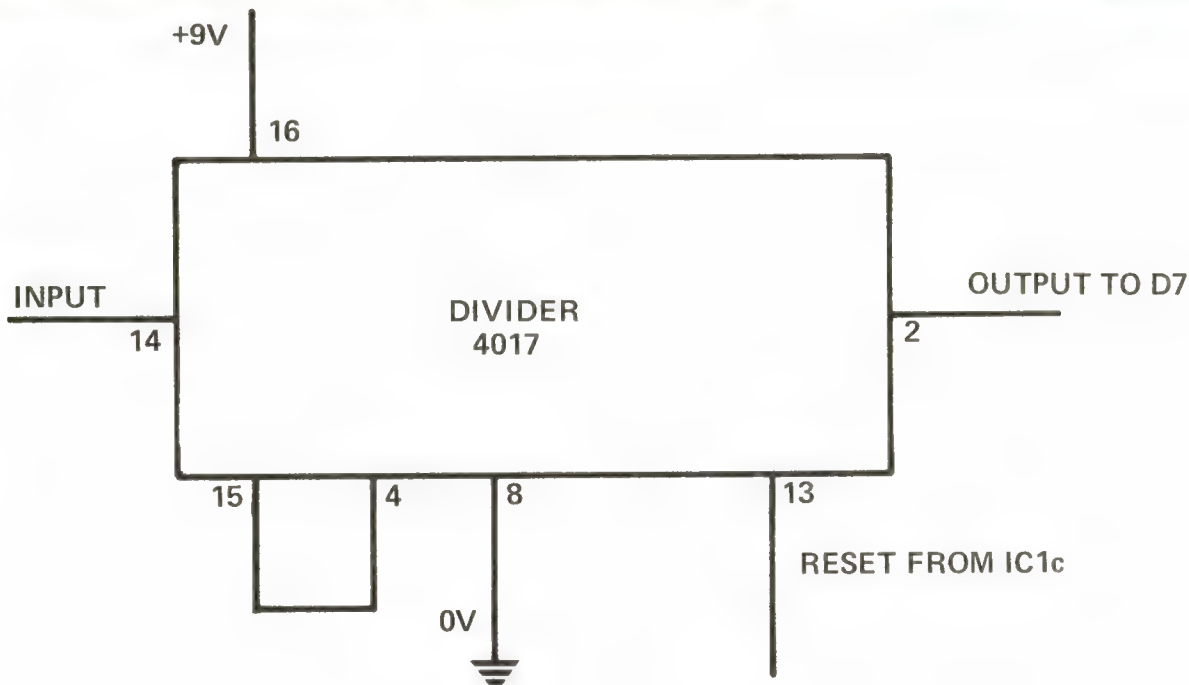


Fig 3 Alternative divide-by-two using 4017

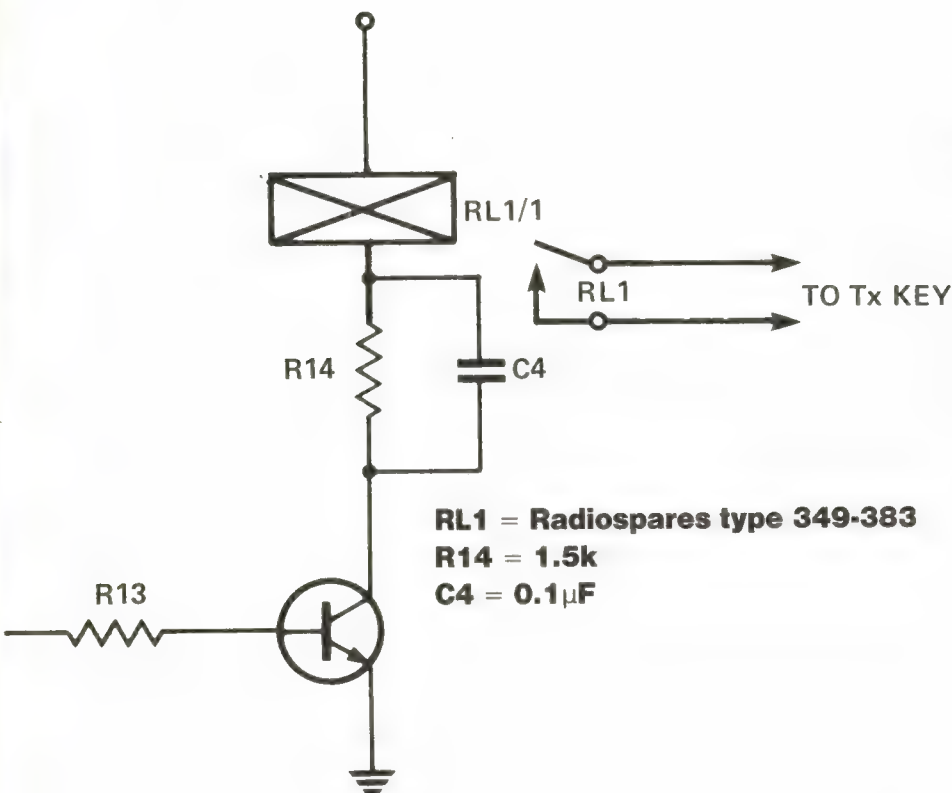


Fig 4 Alternative keying circuit using relay

with the third finger. The keyer is semi-iambic in that dashes can be produced without lifting the first finger off the dot contact.

## Circuit description (refer to Figure 2)

In the circuit to be described the divide-by-two is performed by a CMOS chip, the 4518, a package which contains two independent decade dividers one of which is not used. The 4518 just happened to be in the junk box at the time, but another popular divider, the 4017, was later tried and found to be satisfactory. However an advantage of the 4518 is that the redundant half could be used to divide the initial multivibrator by two to ensure an absolute 1:1 mark/space ratio. Scope observations indicate that this is not necessary and so it was not done in my case. In the following a '1' refers to a high positive voltage, and '0' is zero or low voltage.

## Dots

When the Dot and Earth keys are bridged by two fingers a '1' appears on IC1a pin 3, connected through D1 to IC3a, pin 8, the 'dot multivibrator/(MVB) enable'. IC3a & b form an astable multivibrator whose speed is controlled by RV1, and whose oscillation is dependent on a '1' on pin 8. The output mark/space ratio is as near as makes no matter 1:1, but this can be checked with a 'scope or a voltmeter. The dot stream passes through D8 and R13 to the base of TR1, the keying transistor. The dot element '1' drives TR1 ON and effectively grounds the TX keyline which is connected to the open collector of TR1. Within the keyer and up to the base of TR1 a '1' represents a key-down condi-

the easiest solution is to have one multivibrator for dots and to produce dashes by filling in the space between two adjacent dots.

This is done by dividing the dot speed by two (doubling its length), and combining the two waveforms (Figure 1). This method ensures correct spacing

between elements within any one letter.

## Keyer operation

To operate the keyer the middle finger is placed continuously on the Earth contact. Dots are produced by touching the dot contact with the index finger, and dashes by touching the Dash contact



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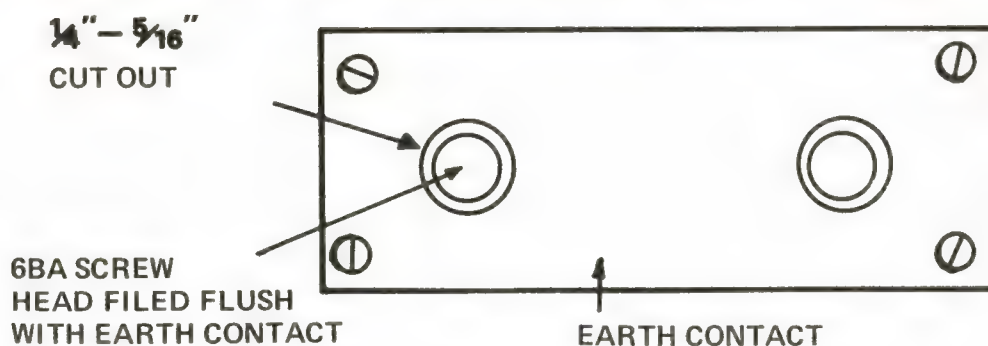
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## PIANO KEYS



**Fig 5** Suggested alternative keying contact which may be easier to construct than three keys

tion. Note that when dots are being keyed, IC2 (the divider) is prevented from operating due to the reset pin (7) being held at '1' by the inverter IC1c.

### Dashes

When the Dash and Earth keys are bridged, a '1' appears on IC1b, pin 11, and the dot MVB is enabled as before. At the same time IC1c receives a '1' through D5 and puts a '0' on the reset pin of IC2, allowing it to operate. The output on pin 3 of IC2 is a half-speed version of the input on pin 1. This output is fed through D7 and R13 to the base of TR1. The second dot in the stream follows immediately afterwards thus completing a dash element equivalent to three dot elements. D7 and D8 form an OR gate to combine the dot stream with the output of IC2.

### Audio monitoring

IC3c & d form an astable multivibrator similar to IC3a & b except that the frequency of oscillation is of the order of 600-700 Hz. It is enabled by a '1' on pin 1 so that a key-down condition causes a tone to be heard in the headphones. The square-wave output is not unpleasant and the level is suitable for sensitive headphones of the 'Walkman' variety.

### Self-completing elements

Dots are self-completing due to the feedback action of D4 which holds the dot MVB enable at '1' regardless of whether there is a '1' coming from the key switch or not. Similarly, dashes are completed by D3 which keeps the dot MVB enabled and keeps C1 charged up, and also by D6 which, through IC3, keeps the reset pin at '0' until the output on pin 3 falls to '0'.

Capacitor C1 performs two functions in the production of dashes. Firstly, in conjunction with R6 it delays the start of the dot MVB until the capacitor has charged. This is only a question of 3 to 5mSecs and is not discernible to the operator. This delay allows the reset of IC2 to be at '0' (i.e. IC2 operative) before the '1' arrives from the dot MVB and ensures reliable switching of the divider. Secondly, C1 ensures self-completion of a dash when the key switch was only

momentarily operated. When the output of IC2 falls to '0' there is still one further dot element required to complete the dash. C1 holds the dot MVB enabled long enough to initiate this final dot, which is completed as before by the feedback of D4. If C1 were omitted, the dash would terminate after two elements only.

### Alternative circuits

A 4017 can be substituted for the 4518 and the alternative circuitry is shown in Figure 3. Almost certainly other divider circuits may be used using flip-flops etc., but I have only tried the 4017 and 4518.

### Transmitter keying

The circuit as described is suitable for my Icom IC701 and, I expect, for many of the current generation of Japanese transceivers with a positive keying line.

If the keyer is to be used with a variety of different transmitters, or to key currents in excess of, say, 20 milliamps, then it may be more practical to use a keying relay. The modified keying circuit is shown in Figure 4. TR1 now becomes the relay driver and R14 is a current-limiting resistor for battery economy. The Radio-Spares relay type 349-383 is a miniature type which mounts in a 14 pin DIL socket. Nominal operating current is of the order of 15 milliamps, so the battery consumption of the unit is drastically increased. However, reliable operation can be obtained at 4 to 5 milliamps if a speed-up capacitor is put across the current-limiting resistor. Assuming a 25-30% duty cycle during operating periods, the average battery current will be less than 2 milliamps, so several months reliable operation should be possible from one PP3.

### Construction

The keyer is built into a plastic project box which is approximately 4.5 x 2.5 x 1 inches, Radio Shack part number 270-221. The two output jacks, the speed control and the key switch contacts are mounted on the body of the box. The battery and circuit board are mounted on the inside of the lid (as shown in photos).

The circuit board is 0.1in pitch Vero-board. Layout is not critical and, no doubt, interested constructors have

their own ideas on how to get the maximum number of components into the minimum space. There is not a lot of space left over and if it is intended to include the keying relay it may be advisable to start out with the next larger size of project box.

In retrospect, a different form of key contact may be easier to construct and may give more reliability in the case of operators with exceptionally dry skin (see Figure 5). The Earth contact has two circular cut-outs (say 1/4in-5/16in) into which the dot and dash contacts are concentrically mounted (6 BA screws may be used). The decreased contact distance, and hence decreased skin resistance, may result in more reliable keying although there is no evidence of erratic behaviour by the original model.

### Conclusion

In digital logic terms there are several ways of achieving the same result, but this is the method I have used and because it worked, I have enquired no further.

Some basic corners have been cut in the interests of miniaturisation, e.g. the dot MVB is not buffered before going into the divider and the audio monitor is low level, LO-Fi. However the underlying principle adhered to throughout is that the quality of the transmitted signal is the criterion that counts the most.

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AC127	0.30	ABoRc	0.12	BC303	0.32	BD375	0.32	BF259	0.32	BT101/500	1.25	BYX36/600	0.22	TIP32C	0.60	Type			Price (£)	Type	Price (£)
AC128	0.35	BC113	0.14	BC307	0.10	BD410	0.76	BF262	0.30	BT102/300	1.35	BYX48/300	0.72	TIP33A	0.63	78L05			0.30	DY802	0.88
AC128K	0.34	BC114	0.14	BC308A	0.10	BD434	0.76	BF263	0.30	BT102/500	1.40	BYX48/600	0.72	TIP33B	0.63	78L08			0.30	DY867	0.75
AC132	0.55	BC115	0.12	BC323	0.09	BD436	0.68	BF270	0.30	BT106	1.50	BYX55/350	0.29	TIP41C	0.30	78L12			0.30	ECC81	0.85
AC141	0.26	BC116	0.15	BC327	0.14	BD437	0.76	BF271	0.26	BT108	1.30	BYX55/600	0.33	TIP42A	0.52	78L15n			0.30	ECC82	0.85
AC141	0.26	BC117	0.12	BC328	0.14	BD438	0.76	BF273	0.18	BT109	1.18	BYX71/600	1.18	TIP47	0.60	78M05			0.30	ECC83	0.75
AC141K	0.40	BC118	0.17	BC337	0.12	BD439	0.68	BF274	0.32	BT116	1.25	BZ12	0.42	TIP110	0.88	78M12			0.50	ECC84	0.75
AC141K	0.40	BC119	0.12	BC338	0.12	BD440	0.68	BF275	0.42	BT119	1.62	CJ08D	0.60	P2955	0.60	78M15			0.50	ECC85	0.90
AC142K	0.48	BC125	0.12	BC350	0.14	BD450	0.59	BF336	0.26	BT120	1.80	E1222	0.30	TIP305S	0.32	78M24			0.50	ECCF9	0.95
AC151	0.45	BC140	0.28	BC440	0.30	BD509	0.54	BF337	0.26	BT121	3.02	E5024	0.30	TIS43	0.32	7805			0.30	ECH81	0.75
AC152	0.45	BC141	0.42	BC441	0.32	BD510	0.48	BF338	0.26	BT138/600	1.30	ET872	0.48	TIS88	0.40	7808			0.30	ECH85	0.75
AC176	0.28	BC142	0.30	BC461	0.32	BD517	0.55	BF355	0.42	BT151/560R	1.90	ITT44	0.04	TIS90	0.25	7812			0.55	ECL86	0.95
AC176K	0.28	BC143	0.45	BC457	0.12	BD518	0.66	BF363	0.82	BT151/300R	1.15	ITT2002	0.11	TIS91	0.11	7815			0.55	EF80	0.88
AC187	0.26	BC147	0.08	BC458	0.12	BD529	0.25	BF367	1.25	BT179/440/300R	2.30	MEO22	0.12	XI108	0.12	7818			0.55	EF86	1.75
AC187K	0.40	AoRc	0.08	BC549	0.12	BD707	0.88	BF371	0.27	BU100A	2.30	MEO40A/2	0.24	ZTX109	0.24	7824			0.55	EF86	1.75
AC188	0.28	BC148	0.08	BC550	0.18	BD718	2.35	BF422	0.38	BU104	2.00	MEU21	0.60	ZTX212	0.28	7905			0.75	F184	0.85
AC188K	0.40	AoRc	0.10	BC550C	0.18	BDX32	2.10	BF450	0.38	BU105	1.20	MJ400	1.25	IN4001	0.05	7912			0.55	EH90	0.54
AC1940	0.88	BC149	0.08	BC557	0.12	BF115	0.32	BF457	0.33	BU105/02	1.56	MJ2955	0.10	IN4003	0.03	7915			0.65	EL34	2.50
AD142	1.10	BC151	0.10	BC558	0.12	BF145	0.82	BF458	0.38	BU106	1.50	MJ3000	1.98	IN4004	0.06	7918			0.65	EL84	0.90
AD143	1.10	BC158	0.10	BC564	0.27	BF119	0.82	BF459	0.44	BU124	1.75	MJ240	0.40	IN4006	0.07	7924			0.65	EL509	5.50
AD149	0.96	BC159	0.10	BCV70	0.15	BF120	0.38	BF460	0.22	BU126	1.25	MJE340	0.54	IN4007	0.07	CA3085			0.30	EM87	2.55
AD161	0.42	BC160	0.30	BCV71	0.17	BF123	0.40	BF461	0.22	BU133	1.80	MJE370	0.88	IN4148	0.08	723C			0.30	EY86/87	0.87
AD162	0.42	BC161	0.30	BCV72	0.18	BF125	0.42	BF461A	0.22	BU204	1.35	MJE520	0.88	IN5400	0.12	LM317K			3.50	EY900A	1.65
AD162/AD162	0.96	BC168B	0.12	BC210	1.68	BF127	0.38	BF461S	0.30	BU205	1.30	MJE2955	0.10	IN5402	0.15	6035			0.15	PCB84	0.85
AF106	0.48	BC169C	0.14	BC211	1.68	BF132	0.16	BF461	0.30	BU206	1.70	MJE3000	1.98	IN5405	0.18	6035			0.15	PCB85	0.50
AF114	2.10	BC170	0.14	BD124P	0.60	BF154	0.23	BF462	0.28	BU208	1.20	MPSL01	0.29	IN5406	0.29	6035			0.15	PCB88	0.85
AF115	2.10	BC170B	0.12	BC130Y	0.68	BF157	0.40	BF468	0.34	BU208A	1.83	OA47	0.70	IN5408	0.20	6035			0.15	PCB89	0.74
AF116	2.10	BC171	0.10	BD131	0.34	BF158	0.22	BF490	1.72	BU208/02	2.05	OA90	0.08	IN5408	0.20	S, F, 10, 15, 10, 50, 100, 200, 500W			0.20	PCF80	0.75
AF117	2.10	BC171	0.10	BD132	0.34	BF159	0.22	BF491	0.38	BU326S	1.75	OA91	0.08	IN5408	0.20	20p each			0.20	PCF86	1.25
AF121	0.82	BC172	0.08	BD133/BD132	0.95	BF160	0.23	BF474	0.38	BU407	1.65	AB5	0.18	IN706A	0.55	20p each			0.20	PCF87	1.25
AF124	0.48	AoRc	0.12	BD136	0.36	BF173	0.32	BF470	0.38	BU407D	1.75	OA200	0.18	IN706A	0.55	20p each			0.20	PCF200	1.55
AF125	0.48	BC177	0.20	BD137	0.36	BF177	0.25	BF444	0.76	BUX80	3.70	OA202	0.15	IN706K	0.55	20p each			0.20	PCF801	1.45
AF127	0.48	BC178A	0.22	BD138	0.38	BF178	0.32	BF439	0.38	BUY20	1.75	OC25	2.10	IN2926G	0.15	30, 120, 270, 470, all at			0.20	PCF802	1.20
AF128	0.68	BC178B	0.22	BD139	0.38	BF179	0.32	BF430	3.58	BUY69B	1.98	OC28	1.70	IN3053	0.22	30, 120, 270, 470, all at			0.20	PCF802	1.20
AF178	0.68	ABoRc	0.08	BD140	0.38	BF180	0.32	BF438	0.38	BUY101	1.98	OC28	1.70	IN3053	0.22	30, 120, 270, 470, all at			0.20	PCF802	1.20
AF239	0.58	BC182L	0.09	BD144	1.60	BF181	0.35	BF255	0.28	BY118	0.68	OC35	1.70	IN3053	0.22	30, 120, 270, 470, all at			0.20	PCF802	1.20
BF279S	0.72	ABoRc	0.09	BD145	1.82	BF182	0.32	BF466	0.26	BY122	0.48	OC36	1.75	IN3053	0.22	30, 120, 270, 470, all at			0.20	PCF802	1.20
LI002	2.50	BC183	0.09	BD150A	0.51	BF183	0.32	BF487	0.26	BY126	0.12	OC42	1.72	IN3053	0.22	30, 120, 270, 470, all at			0.20	PCF802	1.20
LI020	1.88	ABoRc	0.10	BD159	0.85	BF184	0.32	BF489	0.65	BY127	0.10	OC42K	1.70	IN3053	0.22	30, 120, 270, 470, all at			0.20	PCF802	1.20
LI100	2.20	BC183L	0.06	BD160	1.65	BF185	0.32	BF490	0.21	BY133	0.16	OC44	1.72	IN3053	0.22	30, 120, 270, 470, all at			0.20	PCF802	1.20
SY890	1.75	ABoRc	0.12	BD165	0.45	BF184	0.32	BF490	0.21	BY135	0.16	OC44	1.72	IN3053	0.22	30, 120, 270, 470, all at			0.20	PCF802	1.20
UY110	1.40	BC184	0.10	BD175	0.60	BF185	0.32	BF490	0.21	BY152	0.44	OC71	1.50	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
UY102	4.32	ABoRc	0.10	BD182	1.00	BF196	0.10	BF490	0.40	BY179	0.65	OC72	1.50	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A102	0.34	BC207	0.15	BD183	1.10	BF197	0.10	BF490	0.90	BY182	0.87	OC81	0.68	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A110	0.67	BC208	0.16	BD184	1.10	BF198	0.14	BF490S	1.34	BY184	0.40	OC200	2.45	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A121	0.38	BC210	0.15	BD185	0.72	BF199	0.10	BF490	0.72	BY187	0.72	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A129	0.63	ABoRc	0.10	BD202	1.80	BF200	0.47	BF490	0.52	BY189	0.72	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A148	0.16	BC212L	0.08	BD204	0.80	BF222	0.48	BF490	0.58	BY198	0.44	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A154	0.08	ABoRc	0.10	BD222	0.80	BF224	0.20	BF490	1.78	BY199	0.44	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A155	0.10	BC213	0.09	BD225	0.88	BF224J	0.16	BF490	0.38	BY206	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A156	0.08	ABoRc	0.10	BD232	0.45	BF240	0.20	BF490	0.42	BY207	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A157	0.28	BC213L	0.10	BD233	0.10	BF241	0.20	BF490	0.42	BY210/400	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3A164	0.14	AoRc	0.10	BD234	0.82	BF244	0.26	BF490	0.56	BY210/600	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3B104B	0.52	BC237	0.11	BD235	0.63	BF244A	0.28	BF490	0.92	BY210/800	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3B105B	0.48	BC236	0.12	BD236	0.63	BF244C	0.24	BF490	0.34	BY210/800	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3B105G	0.40	BC239	0.14	BD237	0.66	BF245A	0.26	BF490	0.34	BY210/800	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
3B110B	0.38	BC251	0.12	BD238	0.66	BF254	0.15	BF490	0.62	BY210/800	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
BC107	0.10	ABoRc	0.14	BD241	0.80	BF256	0.60	BF490	0.60	BY210/800	0.24	OC202	2.20	IN3096	0.65	30, 120, 270, 470, all at			0.20	PCF802	1.20
AoRc	0.12	BC301	0.30	BD243A	0.80	BF257	0.30	BT109A/02	0.24	BYX10	0.24	TIP31C	0.54			30, 120, 270, 470, all at			0.20	PCF802	1.20

**ORDERING:** All components are brand new and to full specification. Please add 45p postage/packing (unless otherwise specified) to all orders and then add 15% VAT to the total. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome.

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# R&EW Data Brief

TDA2002A

## TDA 2002A

### UNIVERSAL POWER OP-AMP AND AUDIO AMP

The TDA2002 and the slightly souped-up TDA2002A are one of the great standards in linear ICs. Most manufacturers of consumer linear ICs have a version in their range – and most enthusiasts will have seen at least a couple of circuits that feature these versatile devices.

The excessive current drain under no-signal conditions means that battery operation is out. Mains powered equipment would be better advised for using a lower current, higher voltage solution to 10W – but in a vehicular environment, the TDA2002 rules.

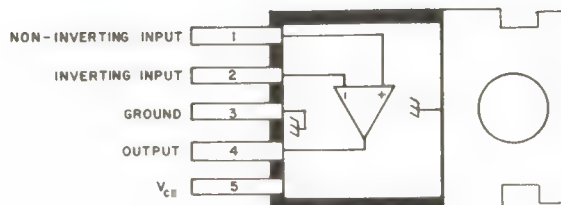
Apart from the obvious audio applications, the TDA2002A can drive vertical output circuits in TV sets and terminals, linear motors – and many applications where the versatility of the power op-amp configuration are applicable.

The difference between the TDA200 and the TDA2002A is that the maximum voltage rating of the latter has been enhanced to 26V DC, with a load current of 2.5A. The TDA2002A can handle up to 60 watts of power (with the right heatsink). The device is protected against thermal, transient and current overloads.

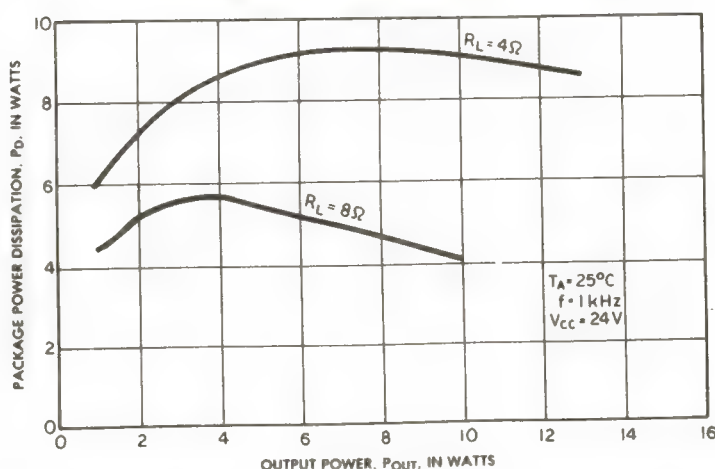
### Applications

When using the device, the usual precautions concerning high gain, high impedance, wide bandwidth devices apply: they 'take off' unless correctly earthed and decoupled. The high frequency oscillations can sometimes melt the loudspeaker voice coil before you realize what's happening, although the low frequency motorboating effects that arise from a combination of high impedance earth and supply leads will only serve to wake you up rather rudely.

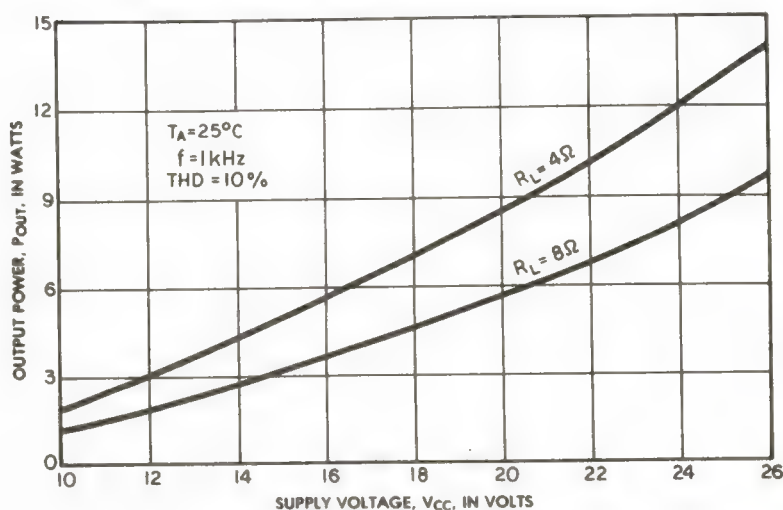
The 2002A may substitute the 2002 in any application, although the cost penalty is such it is only worth the extra if you specifically require the additional voltage capabilities.



### POWER DISSIPATION AS A FUNCTION OF OUTPUT POWER

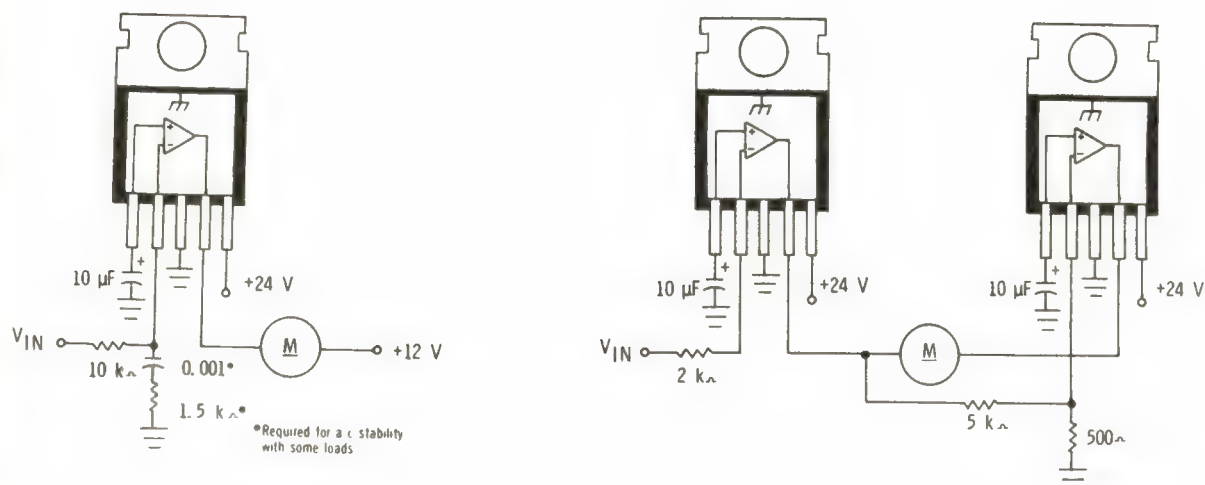


### OUTPUT POWER AS A FUNCTION OF SUPPLY VOLTAGE





# TYPICAL DC MOTOR DRIVE APPLICATIONS



## ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $V_{CC}$	28 V
Peak Supply Voltage (50 ms)	40 V
Peak Output Current, $I_{OUT}$	3.5 A
Non-Repetitive Peak Output Current	4.5 A
Package Power Dissipation, $P_D$	15 W*
Storage Temperature Range, $T_S$	-40°C to +150°C

\*Derate at the rate of 0.25 W/°C above  $T_{1AB}$  90°C

ELECTRICAL CHARACTERISTICS at  $T_A = +25^\circ\text{C}$ ,  
 $V_{CC} = +24\text{ V}$ ,  $R_L = 8\Omega$ ,  $f = 1\text{ kHz}$  (unless otherwise noted)

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Supply Voltage Range	$V_{CC}$		8.0	24	26	V
Quiescent Supply Current	$I_{CC}$	No signal applied	—	80	120	mA
Quiescent Output Voltage	$V_L$	No signal applied	—	12	—	V
Open Loop Gain	$A_v$		—	80	—	dB
Closed Loop Gain	$A_v$		39.5	40	40.5	dB
Total Harmonic Distortion	THD	$P_{OUT} = 0.05$ to $3.5\text{ W}$ , $R_L = 8\Omega$	—	0.2	—	%
		$P_{OUT} = 0.05$ to $5.0\text{ W}$ , $R_L = 4\Omega$	—	0.2	—	%
Audio Power Output	$P_{OUT}$	THD = 10%, $R_L = 8\Omega$	—	8.0	—	W
		THD = 10%, $R_L = 4\Omega$	10	12	—	W
Input Impedance	$Z_i$		70	150	—	kΩ
Power Supply Rejection	PSRR	$f_{ripple} = 120\text{ Hz}$ , $V_{ripple} = 0.5\text{ V}$	30	35	—	dB
Equiv. Input Noise Voltage	$e_n$	$f = 40\text{ Hz}$ to $15\text{ kHz}$	—	4.0	—	μV
Equiv. Input Noise Current	$i_n$	$f = 40\text{ Hz}$ to $15\text{ kHz}$	—	60	—	pA
Input Sensitivity	$e_{in}$	$P_{OUT} = 0.5\text{ W}$ , $R_L = 4\Omega$	—	15	—	mV
		$P_{OUT} = 0.5\text{ W}$ , $R_L = 8\Omega$	—	21	—	mV
		$P_{OUT} = 8.0\text{ W}$ , $R_L = 4\Omega$	—	71	—	mV
Input Saturation Voltage	$e_{in}$		400	600	—	mV <sub>max</sub>
Frequency Response (-3 dB)		$C_{in} = 0.039\mu\text{F}$ , $R_{in} = 39\Omega$	40	—	15 k	Hz
Thermal Resistance	$R_{\theta JA}$		—	—	4.0	°C/W



# 'NOTES FROM THE PAST'

I have been greatly surprised at the very high proportion of hobbyists who, either by force of circumstances or choice, have a self-built workshop. They vary from lean-to's, erected against a blank wall and annexes tacked on behind the garage, to full-blown independent structures standing proudly in their own grounds.

A few years ago garden shedders were few and far between, although many handymen had some sort of outer-building used for storage, keeping the firewood dry, and rough or dirty work. Today's garden-shedders are in an altogether different category and sturdy modern buildings with space heating, strip lighting and curtained windows are apparently becoming commonplace.

With TV, FM etc., our hobby has become more and more complicated. The days have long since gone when one could get by with a soldering iron and a universal meter with the kitchen table as a workbench. Nowadays the keen types think nothing of carrying a comprehensive range of special tools and test equipment which would fill two sides of a medium-sized room.

Pre-war, too, one could practically build a set in a single evening, but a modern FM or TV receiver may well be several weeks in the making. Hence, it is nice to have a place where everything can be left undisturbed with tools and test gear right to hand.

Even those who in the past have been content with a spare corner in the house are beginning to turn to specially designed garden buildings. While a brick and concrete workshop is a mighty expensive proposition if a builder has to be called in, it is neither too costly nor beyond the capability of a versatile radio enthusiast (and most of us are that) especially if one can get the advice and assistance of someone in the building line. In fact, I have more than once been greatly surprised how economically it has been done.

## Money for old rope

Although no one has written specifically on the subject, most correspondents in recent weeks have mentioned their complete agreement with my comments on many of the ITV programmes which spell utter boredom to the intelligent viewer. Whenever I seem to have a little time to spare for casual viewing the screen is filled with interminably dreary Westerns, American quickies and stale films. It is amazing that we should spend dollars on such stuff, and to make it worse ITV are asking

the Government for another 21 hours a week – an example followed less eagerly by the BBC.

Both authorities, especially ITV would be better concerned with putting out improved programmes in their existing hours. It would be nice to have a few 'sensible' programmes. I shudder to think what is going to happen during those extra hours and can only imagine that it will be more programmes suitable for backward adolescents just merely to fill out time in order to justify even more advertising.

More readers feel it would be better, too, if ITV put the money spent on bubble cars, stole wraps, washing machines, bedroom suites, etc., into the programmes. It is to attract the lower types of mentality that such prizes are lavishly distributed for answering questions which should present no difficulty to school-children?

With the BBC sometimes even outdoing ITV in finding some of the worst of the American bookings, many people besides myself, are humbly grateful that 'steam' radio nowadays still carries a satisfying proportion of worthwhile programmes during peak listening hours. And the pleasure is doubled when one listens to them on FM.

Incidentally, three of the ITV programme contractors are increasing their advertising rates by 10% in the autumn, and a fourth on 1st January, but they will charge 20% more during peak hours (7.30 to 10.30 pm). The increases are made on the grounds that the audiences are now much larger. With this swelling of revenue no doubt we shall see really big quiz prizes (if you can only answer such questions as 'Where does Jamaican rum come from?') instead of such trifles as refrigerators and TV sets!

## Lucky for us

It is curious when you come to think of it that the additional TV hours now asked for exceed the total TV hours of a number of European countries. In Austria, for instance, they have three hours each evening except Tuesday, when there is no programme at all. A far higher proportion of their programmes are (if only for this reason) worth while sitting down to watch – instead of merely forming a background of time-filling trivialities which are allowed to drone on while various members of the family carry on doing something else and spare only an occasional glance at the screen.

It is nice, however, to think that we don't have to pay at the same rate for our TV. Their licences, which are renewable

every month cost fifty Austrian shillings (Exchange rate approx. 72 to the £1). Nor must it be overlooked that wages and salaries are considerably lower than they are here. Small wonder no one is expected to pay a year in advance at that rate, but even if one has got the cash a month is the longest period you can take.

Talking about money reminds me – suppose the BBC get the extra hours, where is the additional expenditure coming from? Surely the next move will be to put our licences up to a fiver!

I note also that the House of Commons Public Accounts Committee have turned their attention to ITA's huge profits and consider that future rentals should represent the contractor's full capacity to pay. At this, the Chairman of Associated-Rediffusion is reported as suggesting that if the commercial TV companies have to pay more rent, viewers will get inferior programmes. Which makes me wonder where they are going to find 'em.

## Magnetic attraction

Old timers will recall how we were apt to regard the early permanent magnet m.c. speakers with some suspicion, and wondered just how 'permanent' the magnets would prove to be. Well, just recently I gave the magnet of a very old one to a youngster as a plaything. Later, when he knocked over a boxful of his mother's dressmaking pins he, childlike, collected them up with his magnet. From then on, of course, every time she picked up her scissors she found scores of pins clinging and dangling all over them! Which only goes to prove we needn't have worried about the permanence of those magnets after all.

## Origin of Wharfedale speakers

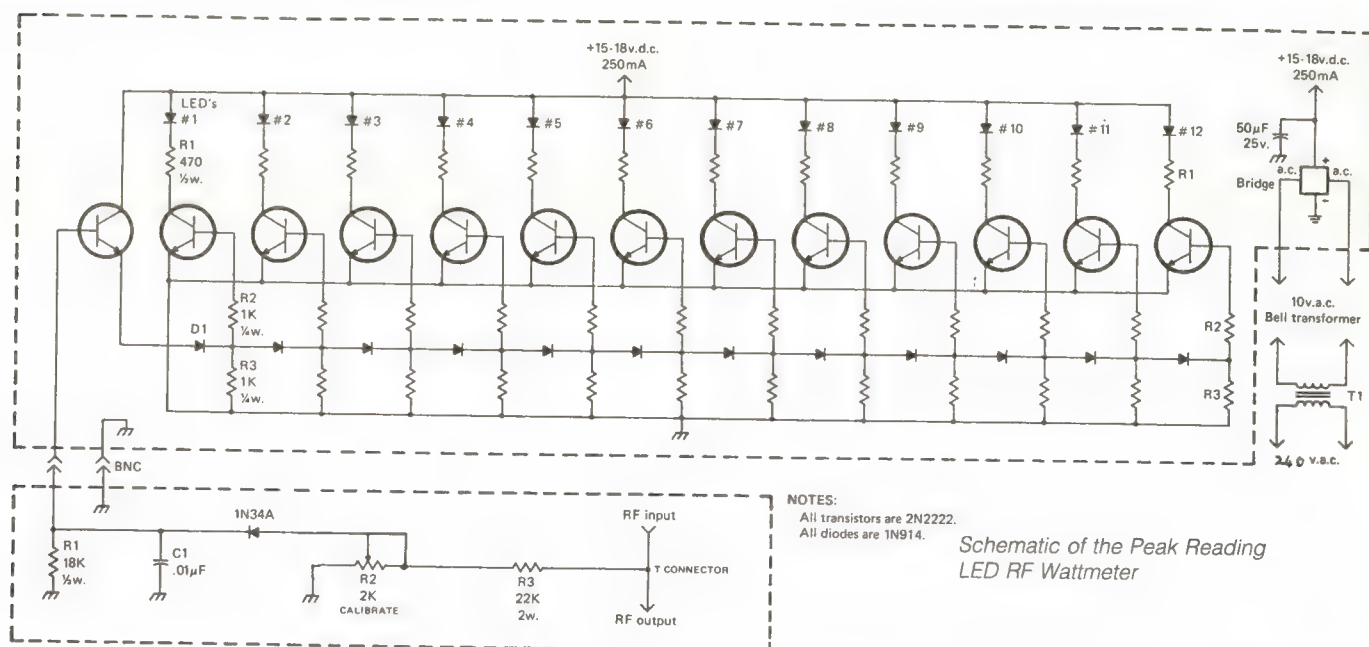
Finally, more old-time memories, this time from W.G. (Bradford 3), were revived by my reference to early loudspeakers. His father-in-law, who was bedfast, was adept at making pleated paper cones which he scored lightly with a darning needle, gluing cork to the centre (instead of the sealing wax I mentioned). Also, instead of using stiff wire between the reed and cork, he used a matchstick. He considers (as did many others) that these were the best thing of their time. Later he bought one of the earliest moving coil speakers from Mr Briggs, whose newly-started business was then in a city centre Bradford basement. This enterprise has now grown into the world-famous Wharfedale business. Incidentally, that speaker gave sterling service right up to the end of the war and after.



# CONSTRUCT A PEAK-READING LED RF WATTMETER

*This practical piece of equipment will make a good addition to your test gear*

by R David Beard, WA4QGA



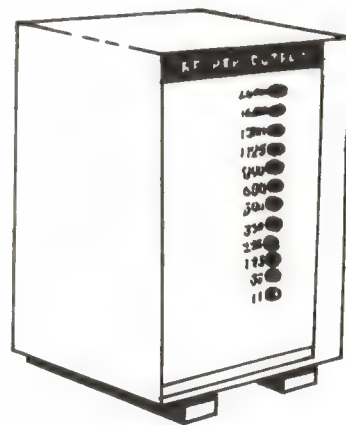
Have you ever wondered just how much power is actually travelling up the coax? The circuit diagram and following description will give you a device that is rugged, easy to build, simple to calibrate, and will tell you how much power you're running. The project is inexpensive to build and reliable in operation.

## Circuit description

The circuit, Figure 1, incorporates 12 LEDs. Each LED is driven by a 2N2222 transistor. Practically any small-signal NPN transistor will do. For turning on each LED at a discrete power levels 1N914 diodes (D1) are used. As the diodes are in series, the LEDs are turned on in sequence as each diode starts to conduct. Resistors R2 and R3 form a simple voltage divider, and resistor R1 limits collector current. Resistor values are not extremely critical as long as all

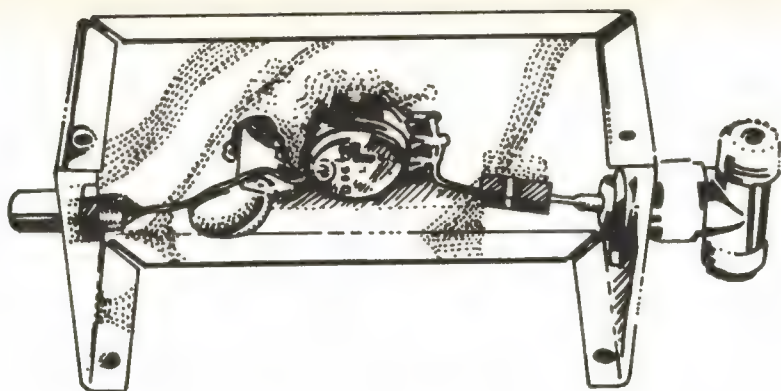
segments contain equal values. The values may be changed somewhat to accommodate on-hand junk-box values. Transistor types are also non-critical as long as all transistors are the same number.

The complete power meter is built on two separate chassis. One is the LED PCB and the other is the sampler unit. Transmission-line voltage is sampled via a 'T' connector connected to an SO-239 on a small chassis. The lower schematic enclosed in dotted lines is the sampler unit. The time constant of R1C1 is only critical in that if C1 is too large, the true peaks will not be indicated. If R1 is too large, the low-order LEDs will have a tendency to stay lit after the r.f. output has ceased, or the LEDs will have a tendency to glow upward as power increases instead of indicating discrete power levels.



Front view of the Wattmeter. You can dress up the completed project to suit your own taste





Interior view. Sampling is done via the T connector. Connection is straightforward and uses normally available components

As the unit is actually a voltmeter and we wish to read the output in watts, Table 1 is included to show the approximate power level each LED will indicate.

After the unit was built and calibrated, the LED display was compared to an oscilloscope (Tektronix 535) voice display on 20m, and true peak values of power were displayed by the meter. For ranges of 0-20 and 0-200 watts, the values of R2 and R3 in the sampler will have to be scaled to provide full-scale readings on the 20 and 200 watt levels.

### Testing and calibration

To calibrate the unit you will need an accurately calibrated r.f. voltmeter or an in-line wattmeter. The single-tone (or two-tone) output level will be the same value displayed by the LEDs as by the RMS value indicated by the two above methods. Calibrate at the highest power level available if a full-scale value cannot be reached.

With no speech 'processing' or 'compression', the highest order LED should flash only on occasions when the peaks of your voice reach the peak limits of

your transmitter. LED flash should *never* indicate higher power output than that reached during carrier condition tune-up.

To test the completed display unit to see that all LEDs light, temporarily connect the input lead, through a 1k $\Omega$  resistor, to the positive side of the power supply. All LEDs should light to their maximum brightness.

This article is from 'CQ' The Radio Amateur's Journal, August 1983, and is reproduced here by their kind permission.

**Table 1 - Relationship between LED numbers in the circuit diagram and the peak power output they reflect.**

LED No.*	Power Output
1 .....	14
2 .....	55
3 .....	125
4 .....	225
5 .....	350
6 .....	500
7 .....	680
8 .....	890
9 .....	1125
10 .....	1390
11 .....	1680
12 .....	2000

\*LED No. 1 is at the bottom of the display.

LED No. 12 is at the top of the display.

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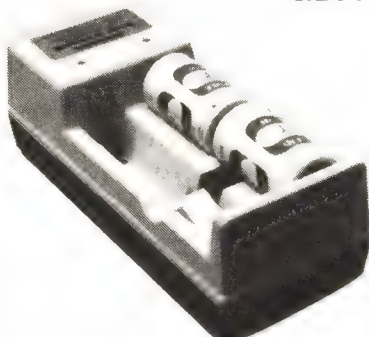
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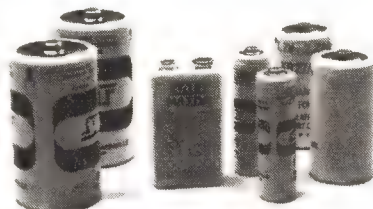
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1/2 AA*	0.24	28.1	14.3	1.45	1.37	1.32
AA	0.50	50.2	14.3	0.90	0.85	0.82
AA*	0.50	50.2	14.3	0.96	0.91	0.88
1.5A*	0.45	28.1	17.3	1.53	1.45	1.38
RR*	1.20	42.1	22.6	1.70	1.61	1.52
C	2.20	49.7	25.9	2.40	2.30	2.20
D (sub)	1.20	60.5	32.9	2.40	2.30	2.20
D	4.00	60.5	32.9	3.50	3.32	3.15
D*	4.00	60.5	32.9	3.59	3.41	3.24
F*	7.00	91.3	32.9	6.85	6.50	6.20
SF*	10.00	91.3	41.7	10.50	9.50	8.90
PP3	0.11	49 x 26.5 x 17.5		4.35	4.10	3.85

\* Denotes cell fitted with solder tags



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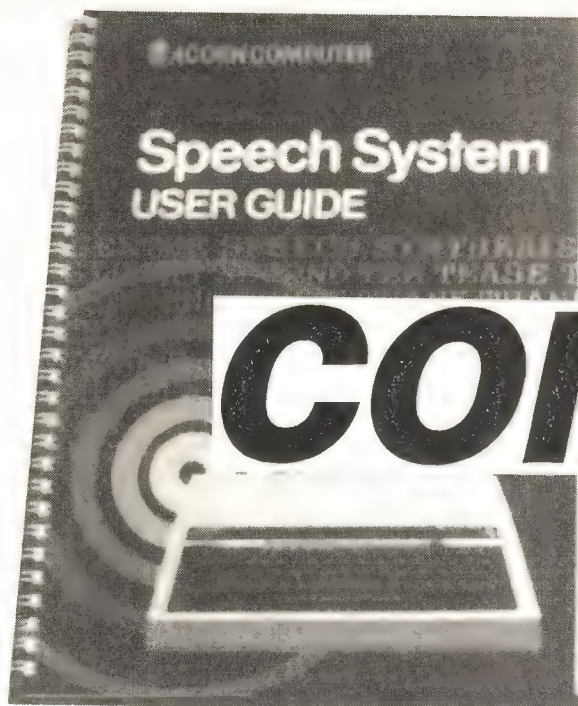
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# SPEECH

and the

# COMPUTER

In last month's issue, Terry Weatherley described the orbit of OSCAR -10 satellite. In this issue, the versatile Terry describes a method of making the Beeb computer articulate. What is the connection between these widely differing articles and why does he include the picture of his little daughter? For the answers to these two questions read on...



Exterminate! Exterminate! The harsh metallic voice of the Dalek is what most readily springs to mind when one hears the term 'computer - generated speech'. Until recently this was a fair reaction; beauty was to be found not in the eye but in the ear of the inventor - and inventors there have been.

In 1791 Baron Von Kempelen invented a speech machine in which bellows imitating the lungs forced air into a leather throat which was distorted by hand to make 'sounds'. It is even reported that Alexander Graham Bell was able to make his dog 'speak' by massaging the dog's throat while it growled. It was not until the 1950's that the first speech synthesizers were demonstrated.

Walter Lawrence in 1951 introduced PAT (Parametric Artificial Talker). Eight speech parameters were measured and their resulting waveforms were painted

onto a glass slide. This was scanned photo-electrically. Lawrence would control the pitch with a pot and was thus able to alter the emphasis.

There is a recording of a demonstration Lawrence gave of PAT in which PAT sang, Lawrence carefully twiddling the pitch control while PAT sang:-

(high) 'What did you say before'.  
(lower) 'What did you say before'.  
(bass) 'What did you say before that'.

It is easy to scoff at these early experiments but in their time they represented the state of the art. They also led directly to more academic research into the field of both human speech and speech synthesis. Interested readers are directed to two classic books 'Speech Analysis, Synthesis and Perception' by James Flanagan of Bell Labs in the USA and 'Speech Synthesis (1973)' by John Holmes of the Government Joint Speech Research Unit.

## Natural speech

People speak by passing air from their lungs into the larynx causing the vocal chords to vibrate. The vocal tract from larynx to lips acts as a resonant cavity amplifying certain frequencies while attenuating others. During speech the tongue and lips are in constant motion thus altering the shape of the vocal tract and hence the position of the resonances.

The sound produced by the vocal chords is rich in harmonics. The larynx cavity produces energy peaks which are called FORMANTS. Figure 1 shows the energy spectrum of speech with three such formants. Formant one is around 500Hz, formant two around 1500Hz and formant three around 2500Hz. This model holds good for a held vowel sound like *aaah*, but in real speech the resonances are constantly changing as the vocal cavity alters its shape. Young



# SPEECH AND THE COMPUTER

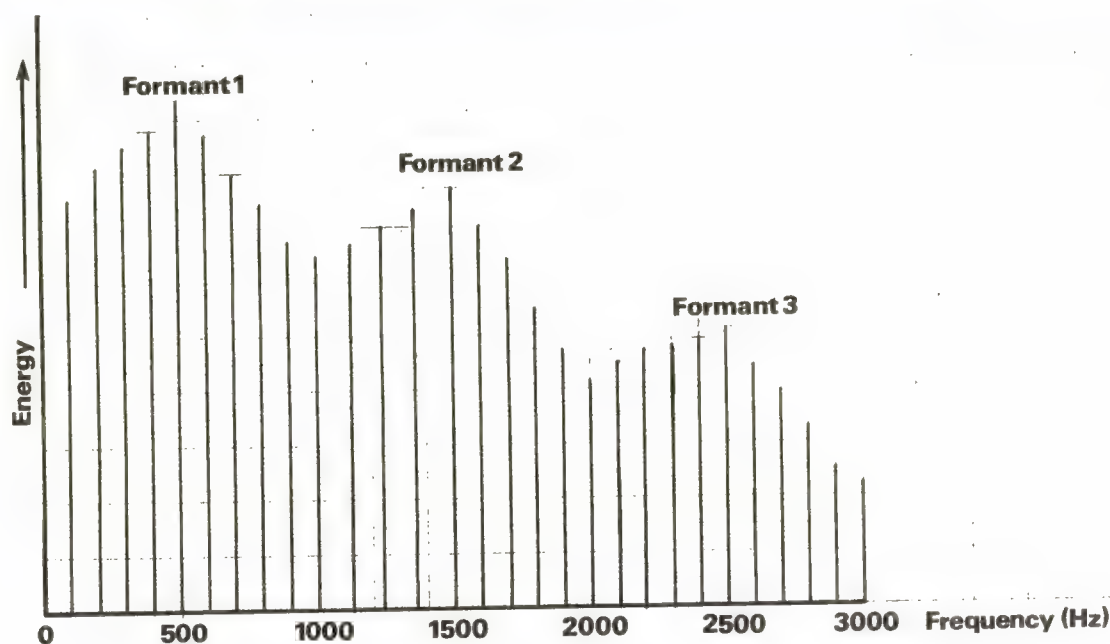


Fig 1 The energy spectrum of speech

children learn to speak by imitating the sounds they hear. (In *Photo 1* the young Miss Weatherley is imitating the sound of a train.)

## Computer speech

The complex waveforms of speech are examined using a sound spectrograph. Typical output is shown in **Figure 2**. It is from such analysis that computer speech is derived. Data from either whole words, allophones or phonemes, the latter two being variations of the basic sounds that make speech. The well known vowel sounds - aa, ee, ii, o, eau - are allophones, while the different 'a' sounds in the words ha, mat, taught, rage, army, about and hair, are all phonemes.

Current speech systems for popular micros using allophones are the Currah Microspeech unit for the Spectrum and the Adam Speech Synthesiser for the VIC 20. The Chatterbox which is available for most popular computers uses phonemes. Both systems have, in theory, an infinite vocabulary but it is up to the user to break the word up into its sounds and using the allophones or phonemes recreate it.

The Acorn Speech System for the BBC Computer uses another route. Speech data from individual words is held on one chip and passed through a 'vocal tract' held on another. The 'vocal tract' is a speech processor which contains a digital filter and requires a large number of parameters to produce the sounds necessary for making speech. Acorn provide a dictionary chip PHROM A (PHrase Read Only Memory) with the parameters of 160 words spoken by Kenneth Kendall the former BBC news-reader.

The speech data is obtained by dividing the speech into frames each

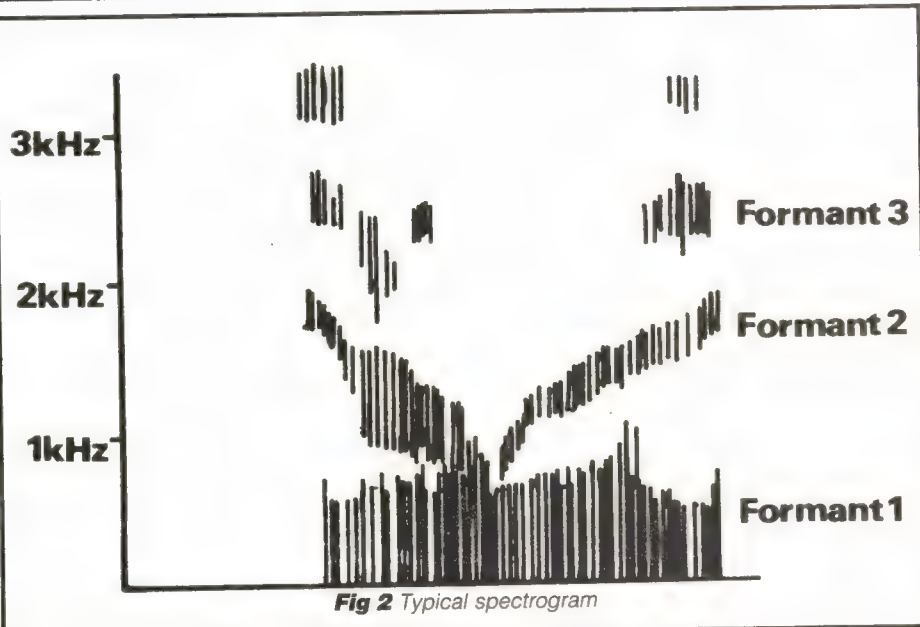


Fig 2 Typical spectrogram

$\frac{1}{40}$ th of a second long. Each frame consists of a number of parameters, the maximum being one energy parameter, one pitch parameter and ten reflection coefficients. The list of words and word parts available in the PHROM is given in *Table 1*. It will be seen that various compound words can be made from the words provided thus increasing the maximum vocabulary. Both chips are made by Texas Instruments. TMS 6100 is the memory PHROM and TMS 5220 the voice synthesis processor. Data Manuals for both these chips can be obtained from Texas Instruments Ltd.

## Beeb speech upgrade

The fitting of the speech upgrade to the Beeb is usually done by the dealer as it is fiddly and may require the cutting of

tracks on the main circuit board, this being dependent upon the issue number of the printed circuit board. If, however, like the writer you are some distance from a main dealer offering this service, then it is possible to fit your own.

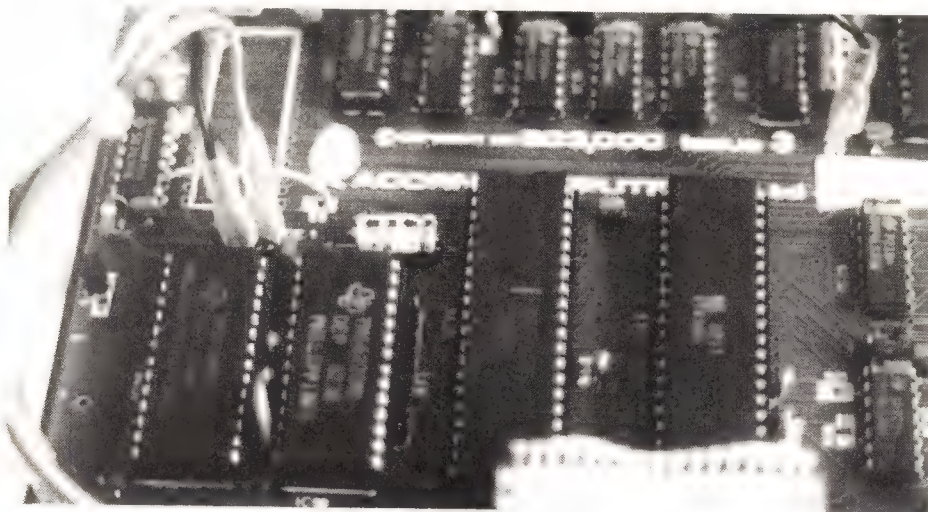
It should be remembered that taking a track cutter and soldering it on to your computer is not to be undertaken lightly. Experience in soldering tiny electronic components, keen eyesight and a steady hand are essential. It must be remembered that fitting the upgrade yourself will almost certainly invalidate any warranty. Having said that, it is fair to say that the speech upgrade kit comes with an excellent step-by-step guide rather in the 'Heathkit' style and, if followed to the letter, no problems should be encountered.



# SPEECH AND THE COMPUTER

## TABLE 1

Word No	Word	Word No	Word	Word No	Word	Word No	Word	Word No	Word	Word No	Word
131	- D	158	NIN-	185	DOLLAR	211	K	238	P	265	THANK
132	- ED	159	A			212	KEY	239	PARAMETER		
133	- ING	160	ACORN	186	DON'T	213	L	240	PENCE	266	THAT
134	- S			187	DOWN	214	LARGE			267	THE
135	- TEE	161	AFTER	188	E	215	LAST	241	PLEASE	268	THEN
		162	AGAIN	189	EACH			242	PLUS	269	THIRD
136	- TH	163	AMOUNT	190	ELEVEN	216	LINE	243	POINT	270	THIS
137	- T	164	AN			217	M	244	POSITIVE		
138	-	165	AND	191	ENGAGED	218	MANY	245	POUN-	271	TIME
139	ZERO			192	ENTER	219	MINUS			272	TRY
140	HUNDRED	166	ANOTHER	193	ERROR	220	MORE	246	PRESS	273	TWELVE
		167	ANSWER	194	ESCAPE			247	PROGRAM	274	TYPE
141	THOUSAND	168	ANY	195	F	221	MUST	248	Q	275	U
142	ONE	169	AVAILABLE			222	N	249	R		
143	TWO	170	B	196	FEW	223	NAME	250	RED	276	UH
144	TWEN-			197	FILE	224	NEGATIVE			277	UP
145	THREE	171	BAD	198	FIRST	225	NEW	251	RESET	278	V
		172	BETWEEN	199	FOUND			252	RETURN	279	VERY
146	THIR-	173	BOTH	200	FROM	226	NO	253	RUN	280	W
147	FOUR	174	BUTTON			227	NOT	254	RUNNING		
148	FOR-	175	C	201	G	228	NOW	255	S	281	WANT
149	FIVE			202	GOOD	229	NUMBER			282	WAS
150	FIF-	176	CASSETTE	203	H	230	O	256	SAME	283	WERE
		177	CHARACTER	204	HAVE			257	SCORE	284	WHAT
151	SIX	178	COMPLETE	205	I	231	O'CLOCK	258	SECOND	285	WHICH
152	SIX-	179	COMPUTER			232	OF	259	SMALL		
153	SEVEN	180	CORRECT	206	ILLEGAL	233	OFF	260	START	286	X
154	SEVEN-			207	IN-	234	OLD			287	Y
155	EIGHT	181	D	208	INPUT	235	ON	261	STOP	288	YEAR
		182	DATA	209	IS			262	SWITCH	289	YES
156	EIGHT-	183	DATE	210	J	236	ONLY	263	T	290	YOUR
157	NINE	184	DO			237	OR	264	TEN	291	Z



The two speech chips TMS6100 and TMS5220 in their sockets

Included in the kit are the edge connectors etc, enabling the famous 'hole in the keyboard' to be activated and a plastic cover fitted. The job is very fiddly and the cutting of the correct tracks which are very, very finely etched on the main board could be difficult. A lino knife might slip, but a 'veroboard' cutter is difficult to locate on the correct track.

### Checking the PHROM

Once fitted, the PHROM can be checked out. Each word in the PHROM

can be 'called' in various ways, by a word number, by its ASCII code number if it is a letter, or by its absolute address. To use the data for the letter 'A' there are three alternatives. The word number is 159, the ASCII value is 65 and the absolute address (in HEX) is B5D. In order to check out the upgrade, the following is typed in with the computer in command mode:- REPEAT:SOUND-1,GET,0,0:UNTIL FALSE. As each key is pressed the GET command returns its ASCII value and thus calls the sound from the PHROM. Lower case letters return

associated words, thus pressing 'p' and 'r' causes the computer to say 'Press Return'.

To add speech to a program, a PROCspeak might be:-

```
1000 DEF PROCspeak
1010 REPEAT
1020 READ A%
1030 SOUND-1,A%,0,0
1040 UNTIL A%=127
1050 ENDPROC
1060 DATA 284,209,267,271,127
```

This should result in the computer saying, 'What is the time'?

The speech is very clear and bears more than a passing resemblance to the data source. Apart from the novelty value it is a useful facility. The Writer's satellite programs need many numbers to be entered and it is very useful to have the computer repeat each digit as it is entered. The educational applications are many. In one program for young children it is essential that they 'press return'. The 'voice' can be made to prompt this after a suitable delay. In all, the Acorn Speech upgrade enhances what is already an excellent machine.

### References

*The Chatterbox*, Witten & Madams, Wireless World: December, 1978.

*Speech System User Guide* - Acorn Computers.

*Speech Upgrade Instructions* - Acorn Computers.



## POINT OF CONTACT

The general interests of some of our readers are shown below. If you have similar interests why not establish a point of contact at the time and on the band indicated

### BYOX:

Usually available early evenings on most days on 2m, 70cm and above. Uses phone, RTTY with computer, SSB, TV. Equipment includes, Icom TR1010 SSB TXCOR, H/brew linear, H/brew FM Synth Rig, 9ELE Tonna, 24 ELE Quad (23cms) and his special interests include VHF/UHF DX, meteor-scatter microwave propagation, homebrew equipment and computer-aided communication. Most interesting contact to date was made with Karl OK1KH/P. Czech 2m SSB.

### GAONF:

Available evenings after 19.30 on HF, 15, 20, 40 and 80 metres, CW only. Uses FT102 equipment and his special interests include DX (Award Hunter). Fifty-nine countries confirmed CW and 3 confirmed SSB. Most interesting contact to date was regular QSO with

VP8APQ during the Falklands War.

### G6LUI:

Usually available Wednesday and Thursday evenings between 19.00 and 20.00 and on Sunday mornings between 10.00 and 11.00 on 2m. Uses phone. Equipment includes TR7500, TR2200GX and TR2100M. His special interest is DXSSB.

### G2DHV:

Usually available most days during the afternoons on 160-80 (A3E/A1A), 20/15/10 (A1A), 10 (F3E) and 4/2 (A1A/T3E) and can be contacted mostly by CW and, occasionally, phone. Equipment is mostly home converted gear plus MX4-MX2-TR2100M, and his special interests include DX, AMSAT, VHF/UHF, Microwaves, ATV/SSTV propagation, aeriels, construction, mobile, satellites and contests (VHF). Most interesting

contact to date: QTH AL41F-JOO1F.

### G6YAK:

Usually available daily except Sundays between 09.00 and 18.00 on 70cm (RB2, GB3 05) using phone. Equipment includes Trio TR9500. His special interests include Amsat, Slow Scan and RTTY.

### G1CMZ:

Usually available most days on 2m FM. Equipment includes Yaesu FT-208R (2.5W/300mW). Indoor  $\lambda/4$  antenna. Special interests include Raynet.

### G2VF:

Usually available most afternoons and evenings on 40, 15, 20 and 10m (CW only). Equipment includes Heathkit HX1681 and DX100 transmitters, HF loop antenna. Special interests include loop antennae for HF bands. RSGB QSL awards. Bureau Sub Manager.

Had an interesting contact with OR4VN during the Antarctic expedition of 1964/65.

### G3AKG:

Usually available Monday to Friday: 08.00-09.00, 09.30-10.30, 15.00-17.00 on 10, 15 and 80 metres. Uses CW and SSB. Equipment includes FT101E (modified), Standard C8500 and Datong downconverter. Special interests are various nets, 80m, KSG, BTI, RNARS and RAOTA.

### G4ASR:

Usually available daily from 16.00 on 70, 144, 432, 1296 and 5760 MHz. Uses SSB, CW, FSTV, RTTY. Has various equipment and his special interests include EME on 144/432 MHz, MS on 144 (432), Auroral, Sporadic-E and DX Tropo. Most interesting contacts made to date: 5B4AZ on 70 MHz, LA6HL/TF Iceland, three QSO's on 144 MHz.

## POINT OF CONTACT

In order to facilitate ready contact between radio amateurs, **Radio & Electronics World** will publish a monthly updated list of licensed readers, including some of the bands they favour, approximate times and days of the week when they operate and a few other details.

**MOST IMPORTANT** – include a **telephone number** – if you have a particularly interesting contact so that we can contact you for details for publication.

If you wish to be included in this scheme, would you please complete and return the form below and send to: **Radio & Electronics World**, Sovereign House, Brentwood, Essex CM14 4SE.

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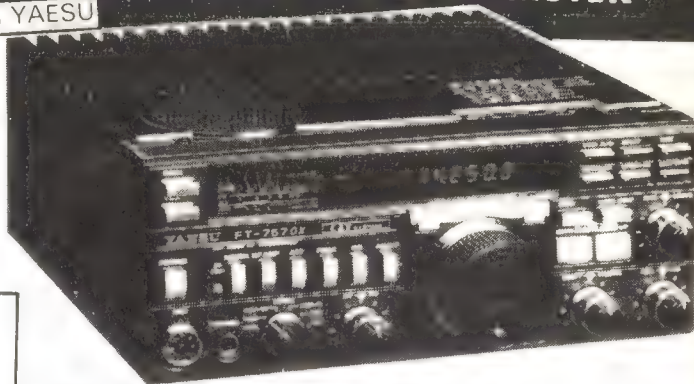
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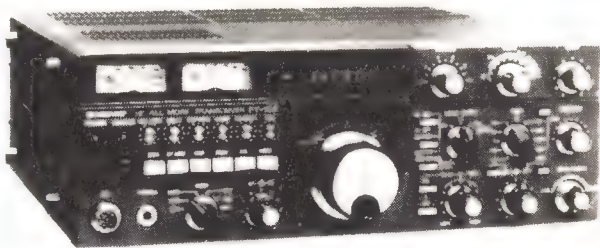
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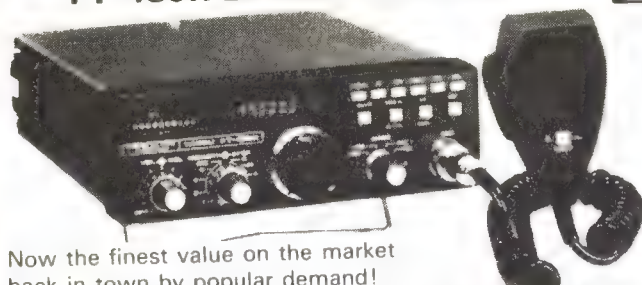


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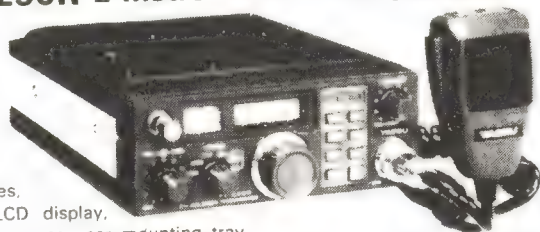


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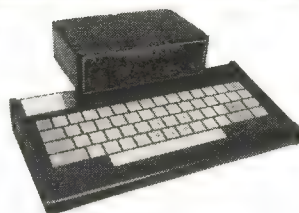
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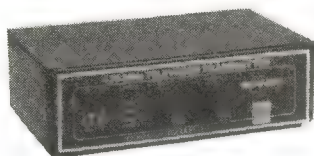
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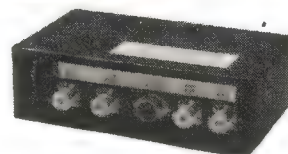


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# A 2 METRE TIGER ANTENNA

If you're looking for an inexpensive VHF high gain antenna this constructional project will interest you

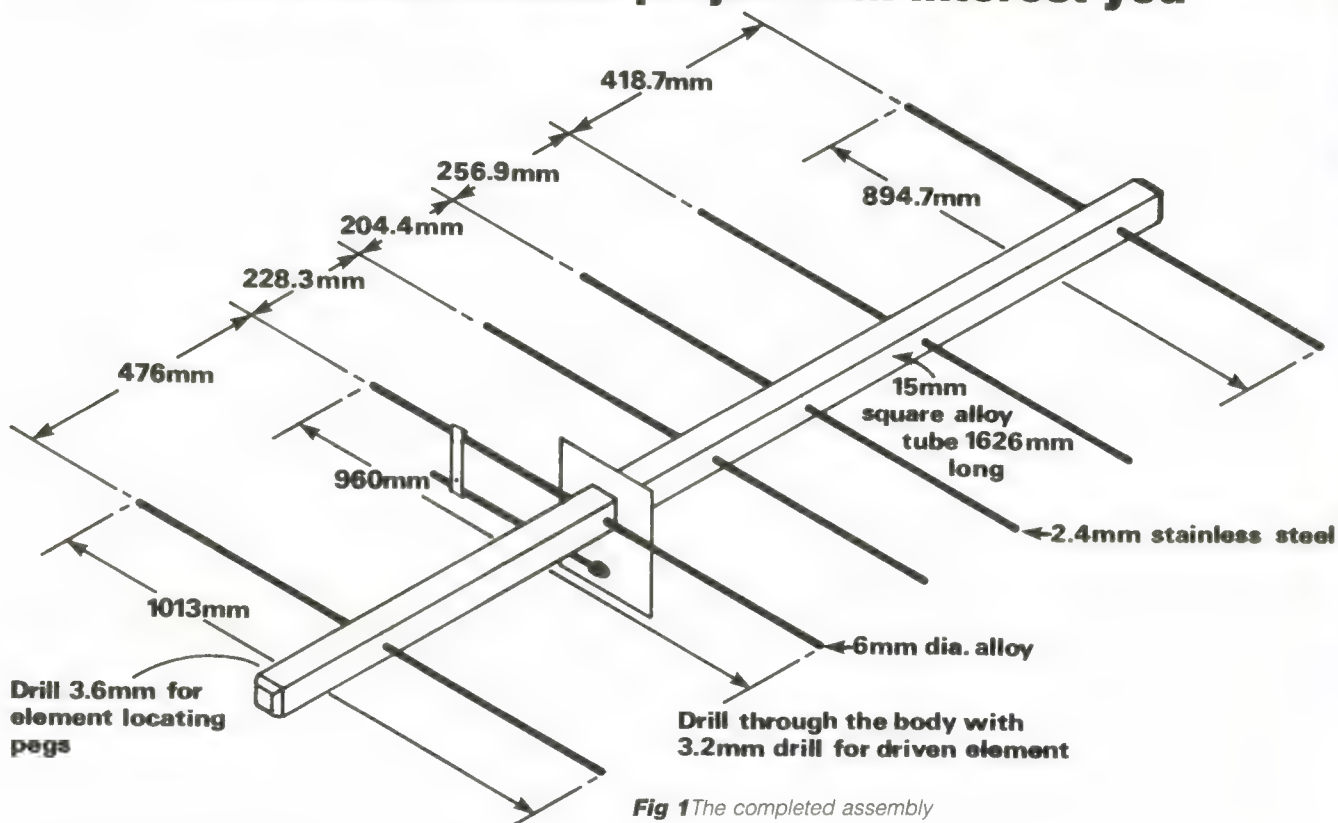


Fig 1 The completed assembly

A constructional project for many heralds the start of a new experience, a step taken very often into a facet of amateur radio previously unexplored, the beginning of new learning sometimes venturing into unrelated subjects in order to master a new interest. The end product provides satisfaction of the achievement and the knowledge of one's own ability to produce the finished work.

This high gain antenna will work extremely well, giving a very good performance in comparison with others in its class, providing the construction details are closely followed.

If you want a six element yagi with plus 9 dBd gain costing under ten pounds for use on the amateur two metre band, then read on.

## Construction

In order to construct the Tiger LY6 antenna, I purchased some components from Ant Products. This company make all the parts for their antenna range available as spares and taking advantage of this fact makes construction very simple, particularly for constructors with limited workshop facilities.

Figure 1 shows the antenna dimensions, boom length, element length and where to drill the holes, etc. The boom is cut from a length of high quality square

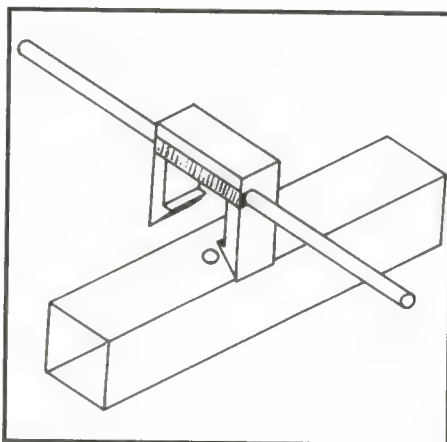


Fig 2 Fitting the element in plastic clip and mounting the clip on the boom

section aluminium tube. Taking care to avoid injury to oneself, deburr the sharp ends and then fit suitable plastic plugs. These will stop water ingress and wind from blowing into the boom. The author's antenna made quite a noise when the wind blew across the ends of the boom.

Care should be taken when marking out the hole positions on the boom and a little time spent in making sure that the holes are drilled in the centre of the boom will prevent difficulty in fitting the

plastic clips that hold the elements in place. Once the boom has been drilled it can then be placed to one side until the elements are cut and fastened into the plastic mounting clips.

As the four directors are all of the same length, a simple jig can be used to mark and cut the stainless steel rod, thus ensuring uniformity of length (see Appendix).

## Fitting the elements

Having cut all the stainless steel elements it is now necessary to fit them into the groove in the plastic clips (Figure 2). It is important that the element is centred accurately in the clip and again the jig can be used to mark the element centres. By utilising the cutting jig and using a felt tip marker pen, the element centres can be easily and quickly marked. Using the mark as a guide, the element is then pressed into the clip using a pair of bull-nosed pliers. A broad-bladed screwdriver can be carefully used to make sure that the element is firmly seated and, if desired, a spot of adhesive can be applied to ensure security, but in the author's case this was not required.

The driven element is the last element to be made and this is cut from a length of aluminium rod 6mm in diameter. First cut



# A 2 METRE TIGER ANTENNA

the element to length and deburr the ends, then find the centre of the rod and mark this position. It is necessary to drill through the rod at this point and to ream the hole to suit a 4BA bolt. Support the rod with a V-block, then using a 2.9mm drill, bore through the element. This drill is the correct tapping size for a 4BA thread.

## Method of tapping

When a pedestal drill is available for use, it is possible to ensure that the hole is squarely tapped by using a method employed by the author. Replace the drill in the chuck with a 4BA tap and with the power switched off, enter the tap into the hole in the rod. Rotating the chuck of the drill by hand will enable the tap to be started and run square. Leave the tap in the hole and release from the drill chuck so that the operation can now be finished by using a tap wrench in the normal way. Clean and remove any burrs from around the hole and check that the element fits into the boom, making a good fit, and will be secure when the fastening screw is tightened.

## Heat shrink tube

The 9.5mm diameter heat-shrink tube is cut to a length of 125mm and then placed over the driven element as shown in Figure 3. Ideally a hot air gun should be used to shrink the tube onto the element (the wife's hairdryer could be tried) but a butane gas blow lamp flame can otherwise be used if care is taken not to burn the heat-shrink tube.

## Support bracket

A bracket to support the SO239 single hole mounting socket is required. Mine was made from a piece of scrap alloy sheet, punched with a hole 16mm in diameter, then bent through 90° and fastened to the boom with two self-tapping screws or pop rivets. The bracket for the socket should be mounted to the boom before the SO239 socket is fitted, otherwise the socket obstructs the fastenings holding the bracket.

## Gamma rod and clips

The gamma rod is made from 8swg copper rod 225mm long, hammered flat at one end and drilled to suit the pin on the socket (Figure 4). Slip the end over the centre pin and solder so that the gamma rod lies parallel to the driven element and is on the same side of the boom as the heat-shrink tube. Make sure that the rod does not short to the body of the socket and when this is done, the assembly should look like the drawing in Figure 5.

It now only remains to make the gamma clip and then the assembly of the antenna can be completed by fitting the elements. The gamma clip is made from 13mm wide, 24 or 26swg brass or copper strip (Figure 6), wrapped around a piece of 6.3mm diameter rod to form the large end, and the small end formed around a piece of 3.2mm diameter rod. A hole is required in the flap part of the gamma

Fig 3 Heatshrink tube and method of fastening driven element

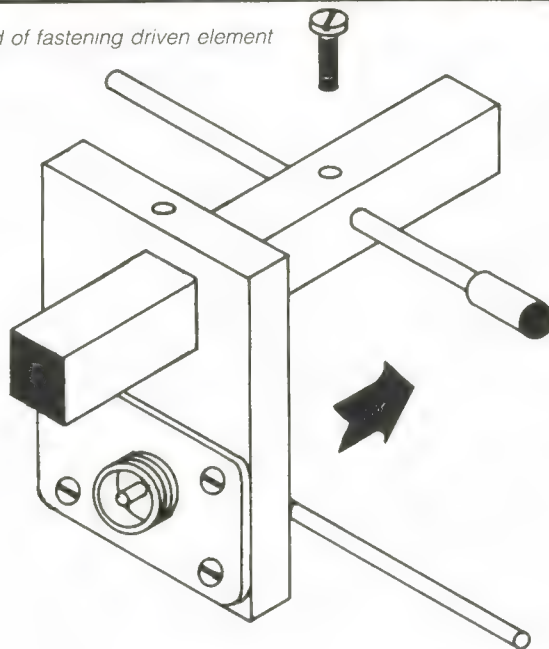


Fig 4 The gamma rod

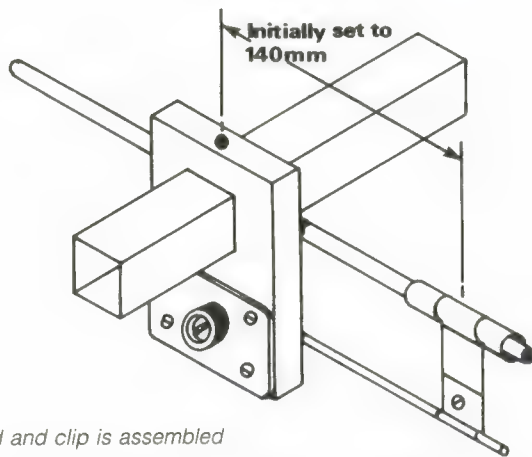
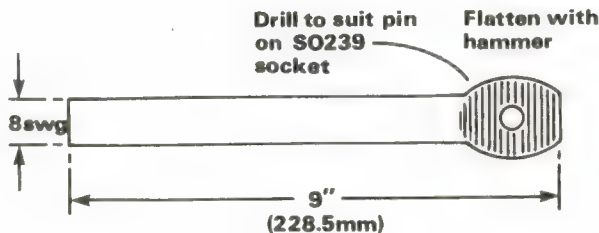


Fig 5 How the gamma rod and clip is assembled

clip so that a 4BA nut and bolt can be used to tighten the small end onto the gamma rod, or it may be better to make the small end of the clip over-tight and then later, after adjustment has been made and the antenna is on tune, solder the clip to the gamma rod. If securing with nut and bolt take care when drilling the thin metal because when the drill breaks through it tends to snatch and result in damaged fingers. Once the correct tuning point has been found, it should not need to be adjusted again, unless major changes are made to the design of the antenna system.

## Assembly and tuning

Fit the driven element and SO239 socket bracket first, then put the SO239 socket into the hole in the bracket and

secure with the nut provided. Discard the solder tag connection ring as it is not required in this application. Fit the gamma rod and solder to the pin on the socket. Put the gamma clip onto the element and slide down towards the boom. The clip should be a snug fit over the heat-shrink tube, sliding smoothly without sticking. Push the smallest end over the gamma rod and adjust to a position about 140mm from the boom. This is the starting point for adjustment. Fit the other elements and then fasten the completed antenna to a support so that it can be held three or four feet from the ground and pointing at the sky. Wooden step ladders are a good support for this exercise.

Opinions on how to set up and tune the antenna differ. However, the following



# A 2 METRE TIGER ANTENNA

Fig 6 Gamma clip details

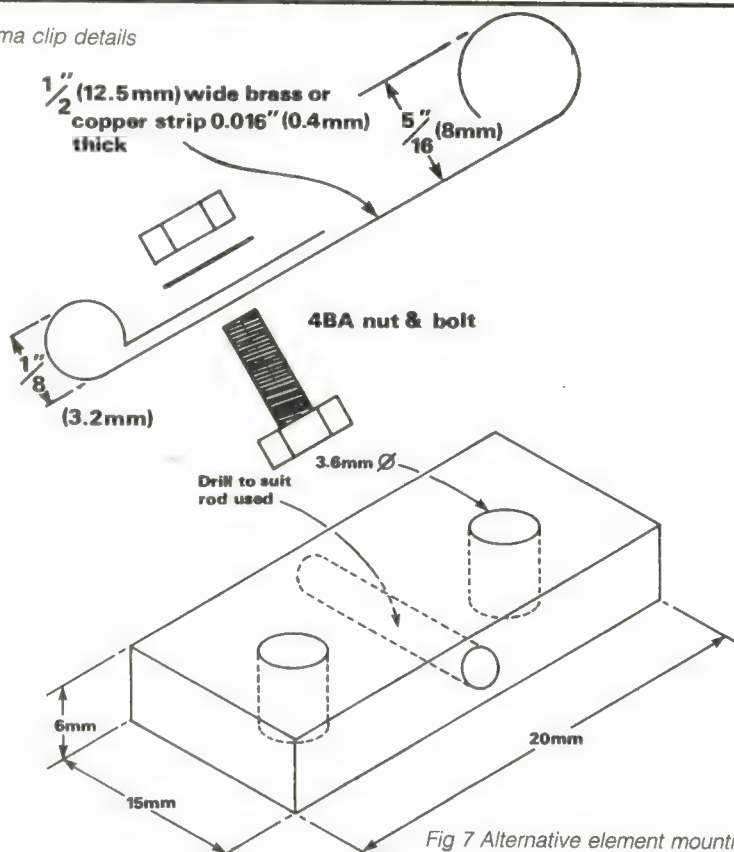
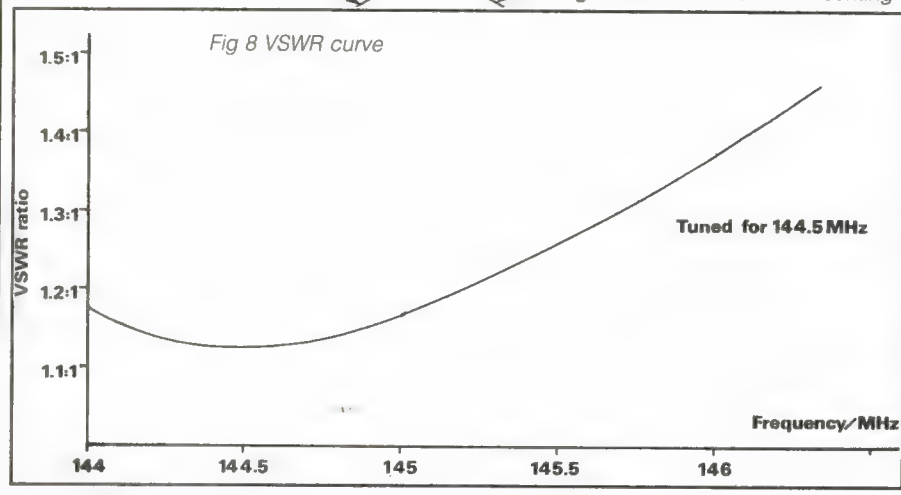


Fig 7 Alternative element mounting



explanation and method is suggested by the author.

First a little transmission line theory. It is well known that a transmission line that is a half wavelength long will repeat any impedance that is placed at one end at the other end, regardless of its characteristic impedance. Therefore, if we take a length of co-axial cable that is a multiple of a half wavelength long and terminate one end with the antenna, we would expect to find the same value of impedance at the antenna repeated at the other end. Because a radio wave propagates more slowly in cables than in free space we must take this into account. The velocity factor, as it is known, affects the tuning frequency and in this case gives rise to the difference 145.5MHz to 144.5MHz, ie a difference of 1MHz.

However, the results will be similar whichever frequency is chosen, because the antenna tuning is very broad across the band. The main difference will be that the VSWR curve (Figure 8) will be lower at whichever frequency is used for setting up.

Back to our co-axial cable. All this means so far is that we can choose where we wish to make our VSWR measurement, either at the rig or at the antenna. My preference is to use a short length of cable three or four halfwave lengths long, not forgetting to include the length of the pin on the PL259 plug. This means that I can make adjustments at the antenna and see the VSWR bridge at the same time.

Because some constructors may have alloy or brass rod available that is not of the right diameter to fit into the clips

from Ant Products, I will describe an alternative method of mounting the elements.

A 20% diameter variation is permissible and because the antenna dimensions are calculated for elements that do not go through the boom but are insulated from it, insulating fastenings must be used (Figure 7). Small blocks made from perspex or polyvinylchloride (PVC) can be drilled to hold the elements and the blocks are secured to the boom with self tapping screws. As long as the diameter of the elements does not vary too greatly from the design value, then no corrections for length/diameter ratio will be necessary.

When the antenna and cable is set up the clip should be moved towards the boom in small amounts until the point of minimum VSWR is found. This should be better than 1.2:1 but may be higher. This is due to the difference in dielectric constant of the heat-shrink tube causing the capacitance value to be wrong. It may be necessary to increase or decrease the amount of capacitance needed by altering the width of the strap used for the clip. The size shown was correct for all of the antenna that I have built, using the specified heatshrink tube. Using the full length of the cable has the advantage that after adjustments are completed the VSWR bridge can be removed and the cable plugged into the rig with the knowledge that the whole system VSWR is satisfactory.

## Weatherproofing

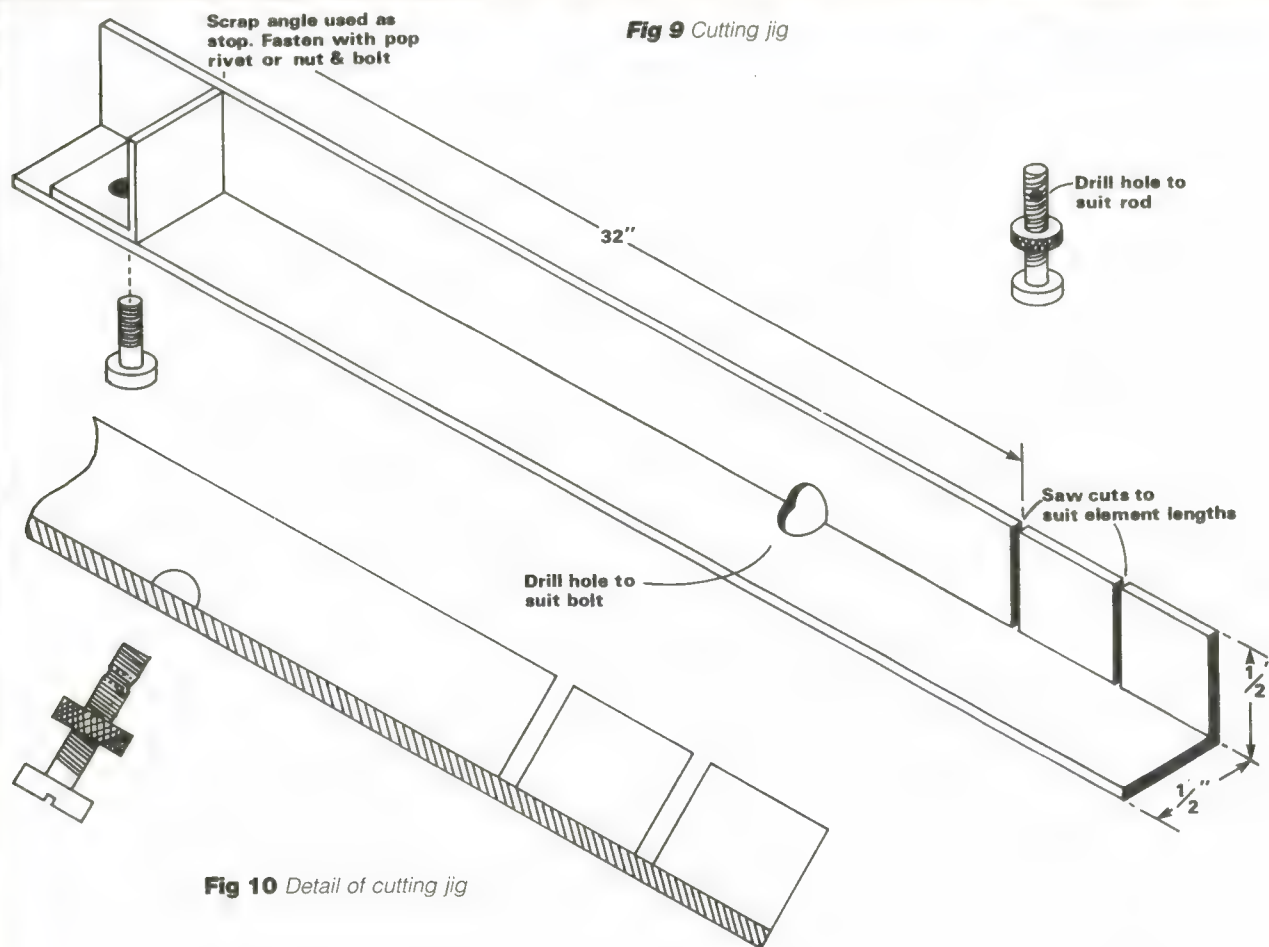
Because the parasitic elements are made from stainless steel no special precautions need to be taken to weatherproof them. However, the alloy and copper parts will deteriorate in time, making the antenna visually unattractive; corrosion may weaken the boom making the joint between the driven element and the boom unsound, and chemical action caused by adverse climatic conditions acting on the aluminium may affect the antenna performance. The SO239 socket is not waterproof and water may migrate into the plug and then penetrate the co-axial cable.

A lesser known fact is that an antenna detunes low in frequency as the driven element corrodes and this reduces the gain of the assembly. This may be as much as 3dB at 144MHz. Tests carried out on new antenna compared against an old antenna (more than six months in use outdoors) show that a popular 19 element antenna lost nearly 2dB of gain and the frequency of resonance dropped by nearly 100KHz. Fortunately, many of these problems can be avoided by taking the time and trouble to use a good quality varnish, painting the antenna carefully using two coats.

However, be warned that some types of varnish are actually quite lossy at two metres and even more so at the UHF frequencies. 'Evostick' is a very good product for insulating and waterproofing the back of the SO239. This product dries



# A 2 METRE TIGER ANTENNA



**Fig 10** Detail of cutting jig

quickly and leaves a tough rubbery coat, very effectively sealing the back of the connector.

Silicone grease inside the plug and shroud will also help to prevent water getting into the co-axial cable.

## Performance

When assembled, adjusted and used in operation, the performance of this aerial compared very favourably with those of a commercial 8-element unit and checks with the beacons showed a noteworthy increase in signal strength. The specification for the 2-metre Tiger is as follows:-

Boom length	1613mm
Weight	0.7Kg
Elements	6
Wind loading	0.5 sq ft
Gain	9dBd
Bandwidth at	2MHz
1 VSWR	
Beamwidth 1/2	50° 'E' Plane
Power points	
Front-to-back ratio	20dB
Parasitic elements	Stainless Steel
Driven element	Aluminium
Connector	SO239
Feed	Universal Gamma Match

## Appendix

Anybody who has tried cutting stainless steel will know how difficult it can be

and using the jig described simplifies the operation.

The jig, almost a constructional project in its own right, consists of a length of 13mm x 13mm x 1.6mm steel angle iron with a stop fitted at one end. This stop is made from an off-cut of angle iron and fastened with a pop rivet or nut and bolt (see Figure 9).

It is necessary to obtain a brass or steel OBA bolt and for a hole to be drilled through the bolt a short distance from the end. This hole should be slightly larger in diameter than the stainless steel rod used for the element. A nut should be screwed onto the bolt so that the bolt can be passed through a hole drilled in the bottom of the Vee of the angle iron, about 32 inches from the stop. This will enable the stainless steel rod to be held securely in the jig.

Carefully mark the angle iron the required distance from the stop to suit the director length and then carefully cut, using a fine bladed hacksaw, halfway through the angle as shown in Figure 10. Do the same for the reflector length.

If care is taken, the jig can be used again and again to produce enough elements for several antennae. To use the jig, pass the stainless steel rod through the bolt and butt up against the stop. Tighten the nut onto the angle iron and this will have the effect of clamping the rod in place, thus preventing it from turning or slipping whilst you are cutting.

## PARTS LIST

Boom 15 x 15mm square alloy tube 1626mm long.

End plugs to suit.

5 metres of stainless steel rod 2.4mm diameter type 308.

5 plastic clips or perspex sheet (see text).

1 metre of 6.3mm diameter alloy rod for driven element.

1 SO239 signal hole mounting socket.

1 length of copper rod or tube 8swg for gamma rod.

Short length of brass or copper strip 13mm wide, 0.4mm thick.

200mm length of 9.5mm diameter heat-shrink tube (Radio Spares).

Nuts, bolts and screws.

1040mm length of 13mm x 13mm angle iron for cutting jig.

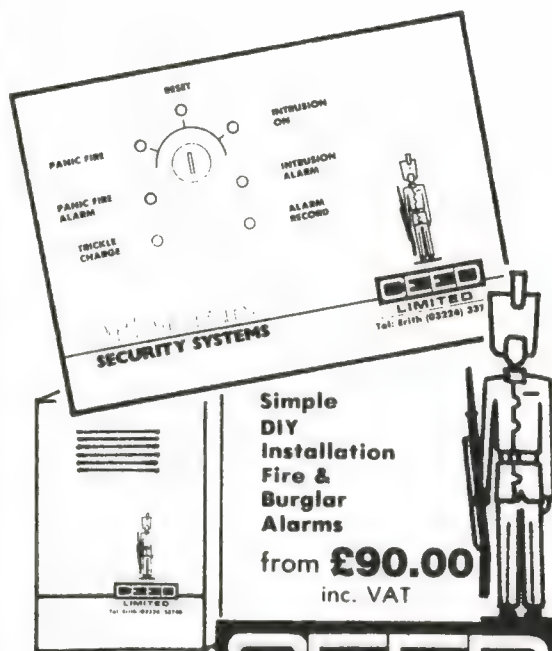
1 mounting clamp.

1 plug shroud.



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MC1327Q 0.95	SN76570N 1.00	TBA520Q 1.10	TDA2002 1.95	
MC1330P 0.75	SN76570N 1.00	TBA530 1.10	TDA2020 2.45	
MC1349P 1.20	SN76600N 0.90	TBA530Q 1.10	TDA2030 2.80	
MC1350P 0.95				

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AA12 0.25	BC174 0.09	BD202 0.65	BF457 0.32	RCA1633A 0.90
AC127 0.20	BC174A 0.09	BD204 0.78	BF458 0.36	RCA1633S 0.90
AC128 0.28	BC177 0.15	BD222 0.48	BF467 0.68	SKE5F 1.45
AC128K 0.32	BC178 0.15	BD222 0.48	BF595 0.23	TP29C 0.42
AC141 0.28	BC182 0.10	BD223 0.48	BF597 0.25	TP29C 0.42
AC141K 0.34	BC182LB 0.10	BD225 0.48	BF597 0.25	TP29C 0.42
AC142K 0.30	BC183 0.10	BD232 0.35	BF597 0.25	TP29C 0.42
AC176 0.22	BC183L 0.09	BD233 0.35	BF597 0.25	TP29C 0.42
AC176K 0.31	BC184LB 0.09	BD234 0.35	BF597 0.25	TP29C 0.42
AC178 0.28	BC204 0.10	BD236 0.35	BF597 0.25	TP29C 0.42
AC187 0.25	BC207B 0.13	BD236 0.35	BF597 0.25	TP29C 0.42
AC187K 0.28	BC208B 0.13	BD236 0.35	BF597 0.25	TP29C 0.42
AC188 0.25	BC212 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AC188K 0.37	BC212L 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AD142 0.79	BC212LA 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AD143 0.82	BC213 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AD149 0.70	BC213L 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AD161 0.38	BC214 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AD162 0.39	BC214C 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AD161/2 0.30	BC214L 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AF114 1.80	BC237B 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AF124 0.85	BC238 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
AF125 0.35	BC239 0.12	BD236 0.35	BF597 0.25	TP29C 0.42
AF126 0.35	BC251A 0.15	BD236 0.35	BF597 0.25	TP29C 0.42
AF127 0.32	BC252A 0.15	BD236 0.35	BF597 0.25	TP29C 0.42
AF139 0.40	BC258 0.25	BD236 0.35	BF597 0.25	TP29C 0.42
AF178 1.95	BC258A 0.35	BD236 0.35	BF597 0.25	TP29C 0.42
AF229 0.42	BC284 0.30	BD236 0.35	BF597 0.25	TP29C 0.42
AU108 3.25	BC300 0.30	BD236 0.35	BF597 0.25	TP29C 0.42
AU110 2.00	BC301 0.30	BD236 0.35	BF597 0.25	TP29C 0.42
BC107A 0.11	BC303 0.25	BD236 0.35	BF597 0.25	TP29C 0.42
BC107B 0.11	BC307B 0.09	BD236 0.35	BF597 0.25	TP29C 0.42
BC108 0.10	BC327 0.10	BD236 0.35	BF597 0.25	TP29C 0.42
BC108A 0.11	BC328 0.10	BD236 0.35	BF597 0.25	TP29C 0.42
BC108B 0.12	BC337 0.10	BD236 0.35	BF597 0.25	TP29C 0.42
BC109 0.10	BC338 0.10	BD236 0.35	BF597 0.25	TP29C 0.42
BC109B 0.12	BC347A 0.13	BD236 0.35	BF597 0.25	TP29C 0.42
BC109C 0.12	BC461 0.35	BD236 0.35	BF597 0.25	TP29C 0.42
BC114 0.11	BC478 0.20	BD236 0.35	BF597 0.25	TP29C 0.42
BC116A 0.15	BC527 0.20	BD236 0.35	BF597 0.25	TP29C 0.42
BC117 0.15	BC547 0.10	BD236 0.35	BF597 0.25	TP29C 0.42
BC119 0.24	BC548 0.10	BD236 0.35	BF597 0.25	TP29C 0.42
BC125 0.20	BC549A 0.08	BD236 0.35	BF597 0.25	TP29C 0.42
BC139 0.23	BC550 0.08	BD236 0.35	BF597 0.25	TP29C 0.42
BC140 0.31	BC557 0.08	BD236 0.35	BF597 0.25	TP29C 0.42
BC141 0.25	BC557B 0.08	BD236 0.35	BF597 0.25	TP29C 0.42
BC142 0.31	BC558 0.10	BD236 0.35	BF597 0.25	TP29C 0.42
BC143 0.24	BC573A 1.80	BD236 0.35	BF597 0.25	TP29C 0.42
BC147 0.09	BD115 0.30	BD236 0.35	BF597 0.25	TP29C 0.42
BC147B 0.09	BD116 0.60	BD236 0.35	BF597 0.25	TP29C 0.42
BC148A 0.09	BD124P 0.59	BD236 0.35	BF597 0.25	TP29C 0.42
BC148B 0.09	BD131 0.32	BD236 0.35	BF597 0.25	TP29C 0.42
BC149 0.06	BD132 0.35	BD236 0.35	BF597 0.25	TP29C 0.42
BC157 0.12	BD133 0.40	BD236 0.35	BF597 0.25	TP29C 0.42
BC158 0.09	BD135 0.30	BD236 0.35	BF597 0.25	TP29C 0.42
BC159 0.09	BD136 0.30	BD236 0.35	BF597 0.25	TP29C 0.42
BC160 0.28	BD137 0.32	BD236 0.35	BF597 0.25	TP29C 0.42
BC161 0.28	BD138 0.30	BD236 0.35	BF597 0.25	TP29C 0.42
BC170B 0.15	BD139 0.32	BD236 0.35	BF597 0.25	TP29C 0.42
BC171 0.09	BD140 0.30	BD236 0.35	BF597 0.25	TP29C 0.42
BC171A 0.10	BD144 0.11	BD236 0.35	BF597 0.25	TP29C 0.42
BC171B 0.10	BD159 0.65	BD236 0.35	BF597 0.25	TP29C 0.42
BC172 0.10	BD160 1.50	BD236 0.35	BF597 0.25	TP29C 0.42
BC172B 0.10	BD166 0.55	BD236 0.35	BF597 0.25	TP29C 0.42
BC172C 0.10	BD179 0.72	BD236 0.35	BF597 0.25	TP29C 0.42
BC173B 0.10	BD182 0.70	BD236 0.35	BF597 0.25	TP29C 0.42
	BD201 0.63	BD236 0.35	BF597 0.25	TP29C 0.42

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BA155 0.13	BY296-800 0.22	IN5401 0.12	
BA156 0.13	BYX10 0.20	IN5402 0.14	
BA157 0.30	BYX36-150R 0.20	IN5403 0.12	
BA158 0.13		IN5404 0.12	
BA159 0.13		IN5405 0.13	
BA160 0.13		IN5406 0.13	
BA161 0.13		IN5407 0.16	
BA162 0.13		IN5408 0.16	
BA163 0.13		IN5409 0.16	
BA164 0.13		IN5410 0.16	
BA165 0.13		IN5411 0.16	
BA166 0.13		IN5412 0.16	
BA167 0.13		IN5413 0.16	
BA168 0.13		IN5414 0.16	
BA169 0.13		IN5415 0.16	
BA170 0.13		IN5416 0.16	
BA171 0.13		IN5417 0.16	
BA172 0.13		IN5418 0.16	
BA173 0.13		IN5419 0.16	
BA174 0.13		IN5420 0.16	
BA175 0.13		IN5421 0.16	
BA176 0.13		IN5422 0.16	
BA177 0.13		IN5423 0.16	
BA178 0.13		IN5424 0.16	
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BA180 0.13		IN5426 0.16	
BA181 0.13		IN5427 0.16	
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# DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

With 1983 now firmly behind us perhaps a brief resume of DX conditions during the past year is in order. It was full of surprises with several tropospheric openings occurring during the early part but few enthusiasts thought the trend would continue. The more notable lifts appeared towards the end of August and during the final week of October when Spanish Band III and UHF signals arrived in the UK.

Sporadic-E (SpE) was unpredictable and produced a short but hectic summer season. However, from September onwards, Band I livened up and throughout October and November there were days when summer-like DX conditions returned. During the main SpE season conditions favoured countries in south-eastern Europe such as Italy, Yugoslavia and Rumania. The latter was a regular visitor during the year. For the lucky few, trans-Atlantic DX was a reality with 525-line signals from the West Indies on channels A2, A3 and even A4. Reception from the Middle East was noted on several occasions from Dubai by Hugh Cocks in East Sussex. Some enthusiasts noted mysterious unidentified signals emerging from darkest Africa but most of us were content with the sight of the Jordanian test card from JTV Amman as our 'exotic' of the season.

## Interference

Coping with interference problems caused by itinerants in Band I, such as illegal cordless telephone users, proved a headache especially for enthusiasts without any real knowledge of interference reduction techniques or those using receiver systems with insufficient selectivity. A few CB experts operating screwed-up rigs caused problems at times for some, but fortunately this form of CB activity seems to be on the decline.

Having reviewed the rest of 1983 let's now concentrate on December. There were two tropospheric openings during the month, one at the beginning and one at the end. Neither was spectacular since the number of transmitters logged was small, but the few that were noted provided excellent quality colour signals at consistently high levels. The 'usuals' logged here at Derby included Belgium and the Netherlands in Bands I, III and at UHF, North-East France (UHF) and West Germany in Band III and UHF from NDR and WDR.

Sporadic-E improved from the 20th producing a mid-winter peak which is often present around the festive season. One signal of note which appeared here for a few minutes on the 21st was a Finnish transmitter on channel E3 radiating the 'YLE TV 1' FuBK test card. The outlet is situated at Tervola which is almost within the Arctic Circle.

Meteor Shower (MS) activity caused a few 'pings' in Band III on channel E5/R6 on several days but nothing was positively identified. Perhaps the Quadrantids during early January will be better.

## Reception reports

Deryck Fentem (Mickleover, Derbyshire) noted several West German ZDF transmitters during the morning of December 4th with an orchestral concert.

BBC-1 North West and Granada TV could have fierce competition from TDF-France around the Wigan area. At least that is how it appears according to Andrew Webster's DX-TV report for the first few days of the month. His location is apparently good for reception of French TV stations and also British ones operating in the south of the UK.

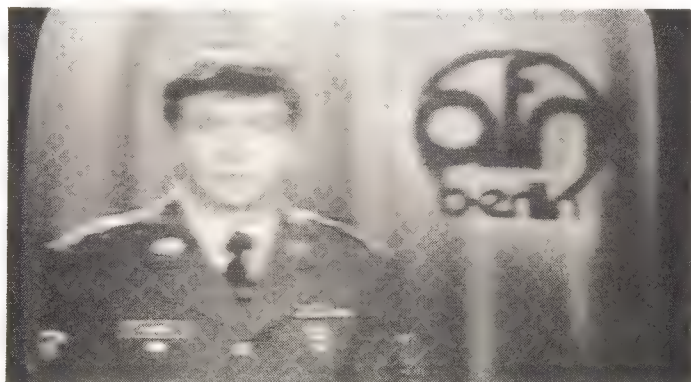
A French ATV station was seen on the 1st, 2nd and 3rd using a pattern similar to

the Philips PM 5544 with the call-sign EDM (Le Havre). Andrew's reception was in PAL colour but the red was missing times. The TDF 'tf 1' (1st Network) PM5544 was noted on the 2nd during an experimental test transmission in Band III using line scrambling technique. Details about this new system were given in last month's column. Other test signals over the period came from West Germany at UHF and Band III and also Belgium, notably BRT on channels E3, E43 and E46. The latter was from the Egem transmitter which radiates the BF 2nd Network.

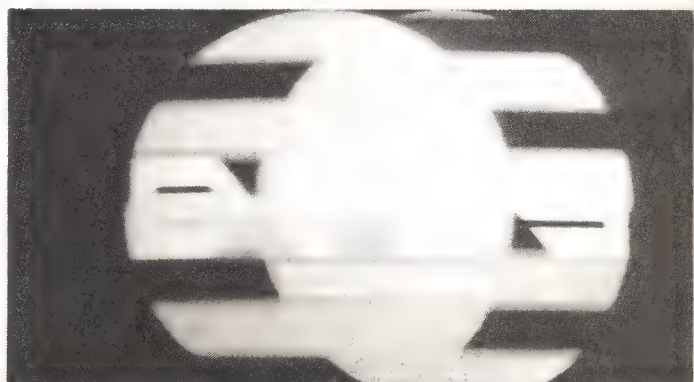
## Outstanding results

The Geminids meteor shower provided Clive Athowe (Blofield, Norfolk) with some outstanding reception in Band I. On the 12th he noted the TSS announcement with the familiar digital clock in the lower left-hand corner of the screen on channel R6 at 2105GMT. TSS were again seen on this channel with a globe caption on the 14th at 2000 and earlier in the day radiating the colour electronic test card. Other Band III MS successes included ORF on E5 (the signal also appeared on the more usual channel E2a) and Sweden on the same channel. Clive is delighted with the results obtained from his new aerial system. He now has a vertically polarised XG21K array which enables him to watch AFN-TV from the channel E34 outlet at Shape in Belgium. On the 29th the signal remained strong during the evening and he noted 'Dynasty' at 2010GMT. The programme was on the 525-line standard with 4.5MHz sound/video spacing (transmission system 'M'). During the early hours of the following morning (Clive had fallen asleep in his shack!) he awoke to note several British Forces Broadcasting Service transmitters on the air at around 0200. They were radiating the PM5544 test card with the identification 'BFBS COLOUR'. In fact Clive logged no fewer than 14 transmitters!

Simon Hamer has once again been very active with DX-TV at his farm near Presteigne in Powys. On the 23rd he noted the Norwegian PM5544 test card carrying the identification 'NORGE HEMNES' on channel E3. The following day reception was enhanced by a lift in trop which resulted in RTB:F on E3 and E8, BRT TV2 on E46 and E62 and NOS. The mischievous antics of Loeki the Lion were seen between Dutch commercials



One of the announcers at the American Forces Network in Berlin. AFN-TV uses the 525-line standard



Identification caption used by the British Forces Broadcasting Service in West Germany



E5 and E29. The West German TV services of ZDF, Westdeutscher Rundfunk and Hessischer Rundfunk were also all to the fore on UHF. Amongst some of the programmes logged were the ZDF news programme 'Heute' and ARD's news bulletin 'Tagesschau'. On the 29th I then received several ATV signals but they were too weak to positively identify. In the radio front, BFBS were romping in at 96.5MHz and managed to swamp the BBC Radio Derby programme which he was trying to listen to. 1984 Started well for Simon as he received a programme from Italy on the RAI channel 1A at 2200 on January 3rd. There were also several unidentified stations received in Band I during an SpE opening. Upon returning home at 1600 on the 10th Cyril Willis (Little Downham, Cambridgeshire) found the UHF band generally crammed with DX. He reports excellent ATV conditions with signals from 19 operators located throughout the UK, Belgium, France and the Netherlands. Two mystery broadcast TV services were also noted. The first consisted of colour bars with 5.5MHz sound from 2050 GMT until the early hours on channel E56. The second mystery was seen from 0030 onwards on channel E34 and was evidently a Dutch pirate station showing an English film with Dutch subtitles. The station closed at 0050 with the identification 'VCN'. It is thought that the initials stand for Video Centre Nederland.

#### Log for December

Meanwhile, here is our log for December:-

**2/12/83:** NOS-1 (Netherlands) Lopik channel E4, Roermond E5 and Smilde E6 on PM5544 test card; ZDF (West German 2nd Network) on E33 from Ostfriesland and E35 (Wesel) both on FuBK test card with 'ZDF' identification; WDR-3 (West Germany) E48 from Wesel on Schools-TV programme caption via early morning tropospheric reception. All these transmitters were also noted during the evening radiating programmes with the following additions: BRT (Belgium) channel E10 from Wavre, NOS-1 channel E39 (Wieringermeer), E47 (Smilde) and NOS-2 E45 (Wieringermeer), RTB:F 1 (Belgium) on E11 from Anlier.  
**3/12/83:** Early morning tropes (0730 until 0830 GMT) consisting of the following:- DDR:F 1 (East Germany) on E11 from Schwerin on test card; NOS 1 and 2 on E4

and E6 together with most UHF outlets using the EBU Bar pattern; NDR-1 (West Germany) from Lingen on E41 using the FuBK without a circle; ZDF E33, E35 and E37 on FuBK pattern with 'DBP ZDF' identification; WDR-1 Teutoburger Wald on E11 with programmes; programmes on channel R1 in Band 1 VHF via Sporadic-E. During the evening amateur TV activity was noted with PE1 DWA from the Netherlands showing a caption and a modified version of the BBC Test Card 'C'.

**4/12/83:** BRT E10, E43 (Egem) and E44 (Genk) on 'BRT TV 1' PM5544 test card; ZDF E34, E35 and E37 with a music programme; NDR-3 E40 (Hamburg) on progs; TDF (France) E42; Dutch ATV stations PE1 1XK and PA3 310.

**7/12/83:** Unidentified signals via MS on channels R1, R2 and E3 all with programme material.

**8/12/83:** CST (Czechoslovakia) R2 using the 'RS-KH' EZO test pattern; ORF (Austria) on E2a transmitting the PM5544; RTB: F 1 E11 showing pages from their teletext service called Percival, noted via weak trop.

**12/12/83:** Geminid MS activity noted in Band III with the PM5544 on E5 from an unidentified source.

**13/12/83:** Unidentified E5 signal via MS with the PM5544 at 0828 GMT, also programmes via MS on E5/R6 at 1755GMT.

**14/12/83/:** MS activity noted between 0730 and 0845 as follows: R2 and R6 programme for approx. 10 seconds; TSS (USSR) on R2 using the 0249 monoscopic test card at 0843 GMT.

**17/12/83:** Short SpE opening at 1322 consisting of ice skating on R1 and unidentified signals on R2.

**18/12/83:** NOS-1 E5 on PM5544 via weak tropospheric scatter; MS activity noted on R1, R2 and E5/R6 throughout the day; TSS R1 and R2 with the clock caption and progs via SpE in the late afternoon; DR (Denmark) E3 with clock caption and programmes via SpE at 1815.

**20/12/83:** CST R1 on 'RS-KH' test card; SR-1 (Sweden) E3 radiating the 'TV 1 SVERIGE' PM5544.

**21/12/83:** YLE (Finland) on E3 from Tervola on FuBK test card via SpE; DDR: F 1 test card on channel E4.

**22/12/83:** CST R1 and R2 with the EZO test card.

**23/12/83:** DR E3 with the 'DR DANMARK' PM5544; NRK (Norway) E3 on PM5544. A late afternoon SpE opening produced

CST on channel R2 with 'Bratislavsky Magazine'; TVP (Poland) R2 on 'TP 1' caption and programmes; MTV (Hungary) R1 with a quiz prog; unidentified programmes on E3 via SpE which are thought to be of Yugoslavian origin.

**24/12/83:** Unidentified MS activity on R2.  
**26/12/83:** TSS R2 using the electronic test card; unidentified colour bars on R1 at 0956.

**27/12/83:** TVP R1 on PM5544 which has a darker background than normal; enhanced tropes gave RTE (Eire) on channel 1H and TDF-2 on E39 from Dunkerque-Mont-des-Cats; BRT E10 on progs until closedown at 2205 GMT with very strong signals' RTB:F 1 E8 and E11 until closedown at 2230. The E11 outlet then radiated the PM5544 test card with 'LEGLISE CANAL 11' ident.

**28/12/83:** NRK E3 from Bagn using the PM5544; DR E3 on test card; early evening tropes consisting of BRT E10 and TDF on approximately channel E11 showing colour bars with text traversing the screen.

**29/12/83:** Excellent tropospheric lift during the evening producing BRT E10, NOS E4 and E5 (the latter was very strong from 2000GMT), RTB:F 1 E3 from Liege plus channels E8 and E11 until closedown at 2225. TDF were seen on E34, E39 and E42 and ZDF appeared on E35 and E37. First Network programmes from West Germany were received from 2200 on E5, E6, E9 and E11 plus a mystery channel located between E5 and E6.

**30/12/83:** SR-1 E2 on test card; unidentified programmes on R2 and R3 via meteor showers.

**31/12/83:** RTE from Gort on channel 1B via MS; TSS R1, R2 and R3 on progs. Weak tropes from Belgium were noted on E3, E8 and E11 from the 1st Network of RTB:F and on E10 from the BRT service.

#### Service information

**Denmark:** Danmarks Radio (DR) started an experimental regional TV service last October via the 60kW channel E7 transmitter at Sonderjylland. The service is known as 'TV-SYD'.

**Hungary:** There is a new 9kW outlet in service at Csavoly on channel R7. It is vertically polarised and radiates the 1st Network of Magyar Televizio (MTV-1).

**Netherlands:** The American Forces Radio & Television Service in Europe (AFN-tv) is expected to bring a 5kW



Transmitter identification caption shown in West Germany from Goettingen on Channel E59



FuBK test card radiated by Sender Freies Berlin. Photo courtesy of Juergen Klassen in West Berlin

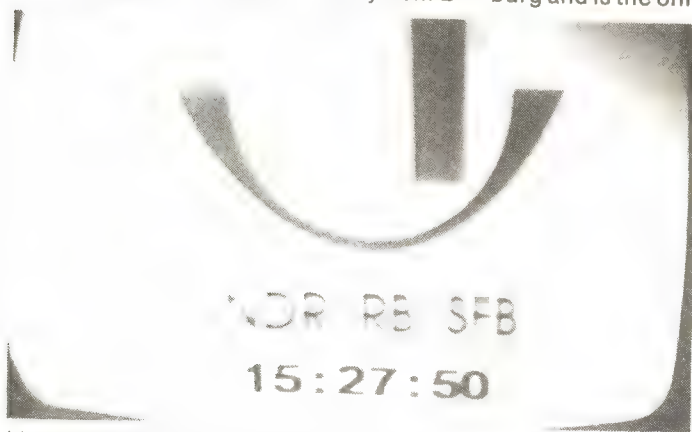


transmitter into service at Soesterberg. It is anticipated that programmes will be received in colour (NTSC) at a distance of up to 15km from the base. It will broadcast on the American channel 82 which corresponds to an 'E' channel of 71/72 and therefore lies outside the standard UHF range.

**Czechoslovakia:** CST have a new method to indicate the TV network when radiating the EZO-type test card. CST-1 remains unaltered but CST-2 has a white square towards the top right-hand corner.

There is a new UHF transmitter on channel R22 located at Roznava. It has an ERP of 100kW.

**Luxembourg:** The channel E7 System B



Identification caption used by three of West Germany's TV networks

outlet at Dudelange has been seen with new identification on their Philips PM5534 test card which is transmitted by the new German language service at certain times of the day. The inscription 'KANAL 7' appears at the top and 'RTL-PLUS' at the bottom.

**Turkey:** The FuBK test card minus the circle has now replaced the Telefunken TO5 test card following the introduction by TRT of colour programming using the PAL system.

**South Africa:** A new independent television service began on January 2nd of this year in one of South Africa's provinces. BOP-TV now beams programmes to black townships near Johannesburg and is the only rival in the country to

the main State-owned TV service operated by the South African Broadcasting Corporation.

BOP-TV radiates the PM5534 test card with identification and the opening caption is shown in Figure 1

**Rumania:** Yet another colour electronic test card is in use prior to the start of programmes. It is the FuBK with the identification 'TVR BUCURESTI' across the centre. The old monochrome EBU Bar is still radiated. Incidentally, the other new colour test card featured in the February issue of R&EW was inadvertently shown upside-down.

Our thanks go to Clive Athowe and Goesta van der Linden (Netherlands) for supplying most of this month's Service Information.



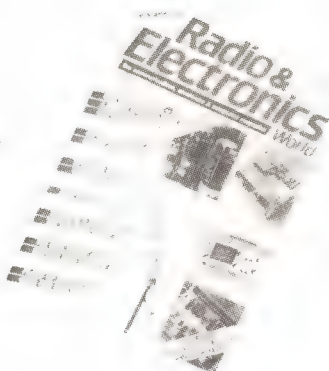
Opening caption of South Africa's first independent - BOP-TV. The first programme to be shown on January 2, 1984 was 'Woody Woodpecker'

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# — DATES FOR — — YOUR DIARY —

Dates for your diary is updated every month.

club secretaries and organisers are requested to send information of forthcoming events as early as possible to *Radio & Electronics World*, Dates for your Diary, Sovereign House, Brentwood, Essex CM14 4SE

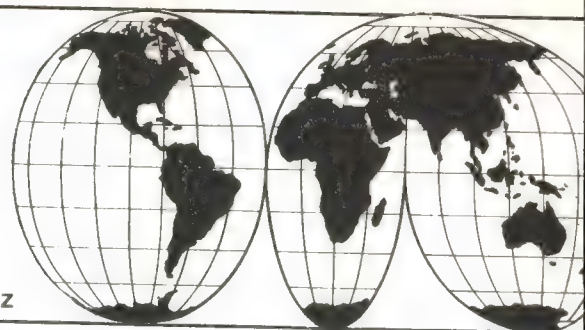
Date	Function	Location	Contact
March-16 April	Lectures on a variety of topics	IEEIE	Tel: 01-836 3357
March	Club project/construction night	S Bristol A.R. Club	L Baker G4RZY
March	Lecture - Amateur Radio on a Shoestring	Lincoln Short Wave Club	Pam Rose G4STO
March	BSC/Computing Award Winner	Lancaster Polytechnic	BSC, Coventry Branch
March	4th Annual Components Fair	Carleton Community Centre	A Mason G4TGU
		Pontefract	N Whittingham G4ISC
	SWL night	S Bristol A.R. Club	G8XIH/G4OPQ
March	Annual General Meeting	Lincoln Short Wave Club	Pam Rose G4STO
March	Computer Night	S Bristol A.R. Club	Terry G6SVR
April	White Rose ARS Rally	University of Leeds	A Bramley G4NDU
April	Microcomputers as applied to amateur	Chelmsford A.R. Society	J Martyr G3PMX
	Radio - talk by A Butcher G3KPJ	Marconi College	AC Mead G4KGB
April	Lecture - Data Comms RS232-X-25	S Bristol A.R. Club	Steve G4MCQ
April	Talk by visitor from Leighton Club	Dunstable Downs Radio Club	P Seaford G8XTW
3 April	Amateur Radio Exhib on computing and electronics	Northern A.R. Society Assocn	P Denton G6CGF
April	Lecture-UHF then and now with a look at	Lincoln Short Wave Club	Pam Rose G4STO
	RSGB Metre- Wave Awards System HF night		
	HF night	S Bristol A.R. Club	Alan G4TSS
	Bring & Buy Sale	Farnborough and District Radio Soc	P Taylor G4MBZ
5 April	Two-Metre FM contest	Stevenage & Dist A.R. Society	B Dean G6NZC
7 April	Display by D Howes G4KQH	Biggin Hill A.R. Club	I Mitchell G4NSD
	C M Howes Communications		
8 April	VHF NFD preparation night	S Bristol A.R. Club	Mark G4KUQ
5 April	Activity night/Night on the air	Lincoln Short Wave Club	Pam Rose G4STO
	'Brains Trust'	Farnborough and District Radio Soc	P Taylor G4MBZ
	10-metre FM night	S Bristol A.R. Club	Colin G4SQQ
7 April	DF Hunt 160 & 2 mt	Dunstable Downs Radio Club	P Seaford G8XTW
8-29 April	RSGB National AR Exhibition	NEC Birmingham	RSGB Potters Bar 59015
May	R F Power Transmitters talk by	Chelmsford A.R. Society	J Martyr G3PMX
	Dick Brocks G3WHR	Marconi College	AC Mead G4KGB
May	Lecture - 23 cms operation	S Bristol A.R. Club	Steve G4MCQ
-7 May	Midland Computer Fair	NEC Birmingham	Fiona Howell 01-643-8040
1 May	TV Show Repeat	Dunstable Downs Radio Club	P Seaford G8XTW
6 May	Fox hunt briefing	S Bristol A.R. Club	G8XIH/G4OPQ
23 May	2 Metre SSB Night	S Bristol A.R. Club	G6ZTX/G6ZTY
25 May	Oscar 10 by G3VZV	Dunstable Downs Radio Club	P Seaford G8XTW
30 May	ATV Night	S Bristol A.R. Club	Peter G8WAX
3 June	Lecture Radio Interference Service	S Bristol A.R. Club	Len G4RZY
3 June	Summer Barbecue at Old Warden	Dunstable Downs Radio Club	P Seaford G8XTV
13 June	Longleat Preparations	S Bristol A.R. Club	G4KUQ/G4RZY
17 June	Royal Navy ARS Mobile Rally	HMS Mercury nr Petersfield	A Walker G4DIU
20 June	Longleat Final Briefing	S Bristol A.R. Club	G4KUQ/G4RZY
22 June	VHF NFD Planning	Dunstable Downs Radio Club	P Seaford G8XTW
24 June	Car Boot Sale	Dunstable Downs Radio Club	P Seaford G8XTW
27 June	VHF NFD Final Preparations	S Bristol A.R. Club	G8XIH/G4OPQ



# SHORT WAVE NEWS FOR DX LISTENERS

by Frank A Baldwin

All times in GMT, **bold** figures indicate the frequency in kHz



It is during this month that the 'season' for the reception of comparatively low powered Far Eastern and South East Asian transmitters on the LF bands closes. But with luck you may hear some of the stations listed here in frequency order, all in the 60-metre band. (**4750** to **5050**).

At the extreme low end of the band may be found the Tibetan transmitter of Xizang PBS (Lhasa) with programmes in Chinese and Tibetan. Opening at 2300 and finally closing at 1545, it is just prior to these times that the DXer should tune to **4750** in order to log or tape the announcements and identification.

Yunnan PBS in Kunming operates on **4763** opening at 2150 and closing at 1600. This is Yunnan 1 which operates, of course, in Chinese.

On **4770** you may be fortunate enough to log Radio Pyongyang. When operating it is scheduled from 1200 to 1300 and from 1500 to 1555.

Radio Thailand, Bangkok, on **4830** is often reported in the SWL press, being on the air from 2245 to 0700 and from 1000 to 1600 with a power of 10kW. Best time to listen for this one is around the 1530 mark according to my experience.

On nearby **4835** you may be lucky enough to hear the signals from Radio Malaysia, Kuching in Sarawak. This one opens at 2200 and finally closes at 1600, the main language being Malayan. With its 10kW signal it is often heard here in the UK.

Tuning to **4840** around 2130 may result in entering into your log the details appertaining to Heilongjiang PBS, Haerbin (Harbin) with the Domestic Service 2 in Chinese and relays of Radio Beijing (Peking). It opens at 2055 (May to October from 2000) and finally closes at 1355. Final closing times are mentioned here for the reasons that (a) they are favourable for reception here in the UK, and (b) like many stations from this general

area of the world operating on the LF bands, they are on the air for two or more differing time-slots. Haerbin, for instance, is scheduled from 2055 (May to October from 2000) to 2300, from 0155 to 0500 and from 0850 to 1355.

Kuala Lumpur on **4845** provides programmes for the local Indian community but you are hardly likely to be confused as the nearest Indian transmitter is that of AIR Bombay on **4840**. Radio Malaysia has a power of 50kW and so is often heard here in the UK. It opens at 2130 Sunday to Friday and at 2200 on Saturday. It closes at 1530 except on Sunday when the sign-off is at 1500.

If you would like to have a go at Mongolia then you may care to tune to **4850** at which point on the dial is to be found Ulan Bator with the Home Service 1 programmes and including some Foreign Service transmissions in Russian and Chinese. For the Mongolian presentations listen at the opening and closing times of 2200 and 1600 respectively. The power is 100kW – and that helps!

Newcomers to the DXing game on the LF bands who have not, as yet, logged a Chinese station would be advised to set the dial pointer to **4865** where will be found the most often reported Gansu PBS in Lanzhou with the Domestic Service in Chinese and some relays of R. Beijing 1. It opens at 2115 and finally closes at 1600, featuring English language lessons weekdays from 0000 to 0030 and daily from 1330 to 1400.

The foreign Service in Mongolian and Russian of Radio Beijing operates on **4883** but is seasonal in that it is on the air from October to April inclusive, opening at 2200 and finally closing at 1600. For some reason I haven't managed to log this one so far this year, probably I have missed the favourable reception periods. Oh well, there is always the next season.

How about Papua New Guinea? Well, you could have a try – it has been reported from time to time by UK DXers. The channel is **4890** and it opens at 1930 and is scheduled through to 1400 continuous. The power is 10kW and probably the best time would be around 2030 and let's hope that the Senegal-based transmitter at Dakar on the same channel is not also making the trip.

Guangxi PBS at Nanning is fairly often heard on its **4915** channel where it opens at 2110 and finally closes at 1605. This is Guangxi 1 in Chinese and dialect, also relays of Radio Beijing 1.

Another Chinese transmitter is that of Qinghai PBS, Xining, on **4940** opening at 2220 and finally closing at 1520. This is the Domestic Service 1 but also has local programmes and some English language lessons, one of these being from 1400 to 1430.

On **4950** there is the often reported Radio Malaysia transmitter at Kuching in Sarawak from where it operates from 2200 to 0100 and from 0830 to 1600 in English and Chinese. The power is 10kW.

Not quite so often logged is Radio Malaysia, Kota Kinabalu, Sabah on **4970** which operates in English and Malayan from opening at 2130 and finally closing at 1600, also at 10kW.

The Chinese station sited at Hunan on **4990** (Hunan PBS, Changsha) can sometimes be heard when conditions are right. This one opens at 2120 and finally closes at 1600.

On **5005** the Malaysian station at Sibu, Sarawak radiates programmes in a local language, opening at 2200 and finally closing at 1500 with a power of 10kW. There is a snag, however, with this one in that it is mostly covered by signals emanating from Radio Nepal, Katmandu on the same channel, opening at 0020 and finally closing at 1720 but with a power of 100kW.

A good general 'marker'

enabling the judging reception conditions for nals from the Far East. South East Asia are th from Radio Singapore. language used is English being directed towards Malaysia – and the late afternoon programme is usually pop records with a announcer. If you can h this station at a fair sig strength then usually it is case that other transmitt in this part of the globe r also be logged – QRM perr ting. Radio Singapore op at 2230 through to 1610 c tinuous, the power be 50kW, the frequency **5052**.

At the high end of the ba is the Chinese transmitt Xinjiang PBS at Urumqi wh features both the R. Bei and local programmes Mongolian, opening at 23 and finally closing with t language transmission 1700. It also features the Beijing Foreign Servi transmission in Russian fr 1800 to 2055 but this, course, is jammed.

## AROUND THE DIAL

This month, a commencement is made by presenting some times and frequencies that may interest DXers who rove over the 90-metre band

## AFRICA

### Ghana

Ejura on **3350** at 0604, O with a talk in vernacular probably a newscast in th Home Service 1 which scheduled from 0530 to 0800 (Sunday until 0900) and from 1530 to 2305. The power is 20kW and this station is on th air irregularly.

Accra on a measured **3360** at 0608, OM with a newscast in English. On this frequency Accra is scheduled from 0530 to 0800 (Sunday until 0900) and from 1530 to 2305, the same as Ejura but with a power of 10kW.

### Liberia

ELWA ('Eternal Love Winning Africa') Monrovia on



0 at 2156, OM with a talk in vernaculars. This is the Home Service entirely in vernaculars and on the air from 0600 to 1800 and from 1805 to 2230 with a power of 10kW. Programmes are mainly religious.

**BS (Liberia Broadcasting System)** Monrovia on **3255** at 1803, OM with a newscast in English. This 25kW transmitter is on the air from 0458 (Sunday from 0558) to 0700 and from 1830 to 2400.

## Malagasey

**Tananarive** on **3287** at **1656**, OM with a song in vernacular complete with local orchestral backing. Earlier in the month however Tananarive is logged on a measured **35.8** at 1754. It is timed as operating from 0300 to 0500 and 1500 to 1900 in Malagasey and from 1900 to 2100 in French. The power is 100kW.

## Malawi

**Blantyre** on **3380** at 1750, OM and YL with announcements, OM's with songs, all in Chichewa. The schedule is 1555 to 0530 (until 1110 from April to September) and 1745 from 1300 April to September to 2215. The Foreign Service in English is from 1600 to 1700 and the power is 100kW.

## Namibia

**Windhoek** on **3270** at 1743, OM with announcements, OM with songs in vernacular. This is the SWABC local languages service which operates 0400 to 0515 and 1600 to 2200, at which latter time the SABC All Night Service commences and continues to 2400. The power is 100kW.

**SWABC Windhoek** on **3295** at 0140, YL with a pop song in English in a relay of the SABC. All Night Service timed from 2200 to 0400 which is in parallel with that mentioned above. The remainder of the schedule is from 0400 to 0615 and from 1600 to 2200 in English, Afrikaans and German. The power is 100kW.

## Nigeria

**Lagos** on **3326** at 0554, YL with songs in vernacular, OM with announcements. 'Radio Nigeria' is scheduled from 0430 to 1000 and 1700 to 2310 with a power of 50kW.

## South Africa

**SABC Johannesburg** on **3250** at 0156, pop records with announcements by OM in English during the All Night Service programme timed from 2200 to 0300. The 'Radio

5' schedule is from 0300 to 0545 and from 1530 to 2200. The power is 100kW.

## Togo

**Radio Difusion de Kara** on a measured **3222** at 0559, OM's with a song in vernacular backed by a rhythm section local-style. OM with station identification and announcements in French at 0600. This 10kW transmitter is scheduled from 0530 to 0830 and from 1630 to 2305.

## AMERICA-SOUTH

### Brazil

**Radio Riberao Preto** on **3205** at 0050, YL with a talk in Portuguese then OM with folk songs. On the air from 0800 to 0400 at 1kW. **Radio Cultura, Araraquara** on **3365** at 0242, OM with a talk about local events - mostly sports. In Portuguese from 0800 to 0300 at 1kW.

### Ecuador

**Radio Iris, Esmeraldas** on a measured **3381** at 0153, OM with a talk in Spanish this followed by some local-style music. The schedule is from 1000 (Sunday from 1100) to 0400 variable and the power is 10kW.

**Sistema de Emisora Atalaya, Guayaquil** on a measured **4792** at 0232, OM with a sports commentary in Spanish with much trilling of the R's - an accomplishment greatly admired in Latin America. The power is 5kW, the schedule 0100 to 0455.

### Peru

**Radio Inca, Lima** on a measured **4762** at 0225, YL with a talk in Spanish about the Peruvian President ('Presidente') followed at 0230 by OM with station identification and Andean pipe music. R Inca is on the air from 1000 to 0500 but has been reported varying the closing time up to 0600.

### Colombia

**La Voz de Yopal** on **5050** at 0200, OM with station identification in Spanish then a long talk about local politics with several mentions of Colombian place-names. The schedule is from 1030 to 0400 and the power is 1kW.

## EUROPE

### Denmark

**Copenhagen** on **15165** at 1058, interval signal then OM with station identification in English and target areas.

Chimes for 1100 then into the Danish transmission for Greenland and the Pacific, timed from 1100 to 1150.

## Greece

**Athens** on **11645** at 1140, YL with a newscast in Arabic to Egypt and Libya, scheduled from 1130 to 1150.

## Spain

**Madrid** on **9650** at 0832, OM with announcements in the Spanish-language 'Programa Mundial' (Worldwide Programme) scheduled on this channel from 0600 to 0930.

## Switzerland

**Berne** on **25780** at 1030, 'pips' time-check, YL with station identification in English followed by the Music Programme for Europe and Africa, timed from 1030 to 1100.

## Vatican

**Vatican City** on **11700** at 2055, OM with an English transmission to Africa. The daily schedule being from 2045 to 2100.

## FAR EAST

### China

**Jilin PBS (People's Broadcasting Station)** on **3310** at 2202, OM with a talk in Chinese. Jilin is on the air from 2050 to 0530 and from 0850 to 1500. From 2100 to 2130 there is an English language lesson and also from 1330 to 1400 but this one is unlikely to be heard here in the UK.

**Radio Beijing (Peking)** on **3220** at 2206, OM with a talk in Chinese in the Domestic Service 1 Programme from 2000 to 2330 (November to April until 2300) and 1400 to 1735.

## MIDDLE & NEAR EAST

### India

**AIR (All India Radio) Lucknow** on **3205** at 1520, OM with a talk in Hindi scheduled from 0025 to 0215 and 1215 to 1740 with a power of 10kW.

**AIR Gauhati** on **3235** at 1534, OM with a newscast in English. The schedule is from 1230 to 1700 (Saturday until 1740) and the power is 10kW.

**AIR Madras** on **4920** at 1527, YL with a song in Hindi, some local-style music. YL with announcements and station identification, 'pips' time-check at 1530 then OM with the local news in English.

**Madras** is scheduled from 0025 to 0215 and from 1200 to 1740. The power is 10kW.

## Israel

**Jerusalem** on **7410** at 2230, OM with station identification and the news at the start of the English transmission to Europe and the Americas, timed from 2230 to 2300.

## Pakistan

**Karachi** on **21800** at 1100, OM with station identification, time check as '1600 hours Pakistan time' then the news in English at dictation speed, scheduled from 1100 to 1115.

## SOUTH-EAST ASIA

### Australia

**ABC Brisbane** on **4920** at 1950, OM with announcements in English during a programme of local and UK pop records. Scheduled from 1900 (Sunday from 1930) to 1402, power is 10kW.

## INDONESIA

**RRI (Radio Republik Indonesia) Tanjung Pinang** on **3225** at 1528, OM with songs in Indonesian. This one closed at 1555.

**RRI Banjarmasin** on **3250** at 1526, YL with a song then some Gamelan music. This transmitter closes at 1520. Power is 10kW.

**RRI Bengkulu** on **3265** at 1533, OM with a talk in Indonesian. At 10kW, Bengkulu signs-off at 1600.

**RRI Padang** on **4002** at 1553, YL with songs in Indonesian. Padang is off at 1600 (Saturday at 1700) power is 10kW.

**RRI Medan** on **4764** at 1549, YL with a talk in Indonesian. Medan signs-off 1700 and has power 50kW.

## CLANDESTINE

Voice of the United Muslim Fighters of Afghanistan' on **15305** at 1552, OM with fiery sounding announcements in Pashto or Dari, I'm not sure which, OM with a quotation from the Holy Quran.

## NOW LOG THIS

**Radio Nepal, Kathmandu** on **3230** at 1524, YL with songs in Nepali, local-style music. Closing at 1720, it is in parallel on **5005** and the power is unknown but the latter frequency is listed as 100kW.

## NOW HEAR THESE

**Turkish State Meteorology Service, Ankara** on **6900** at 1530, YL with a local pop song then some Turkish-style music. This one is scheduled from 0358 to 0600, from 0700 to 0840 and from 1100 to 1550 with a power of 2.5kW. The address is Post Office Box 401, Ankara.

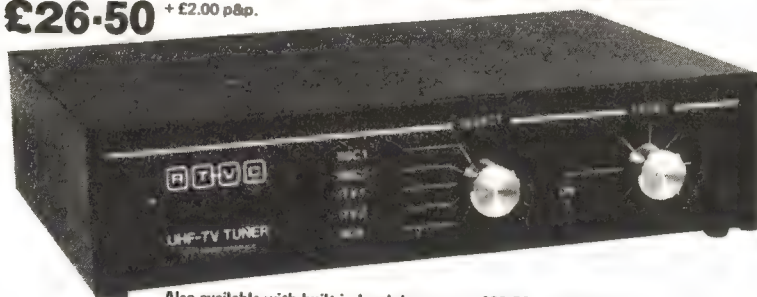


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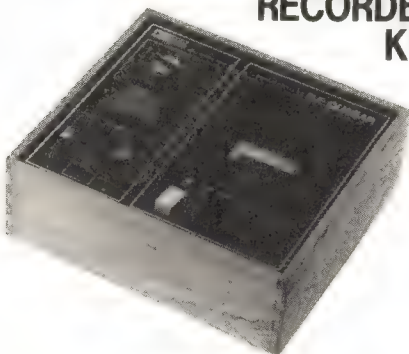
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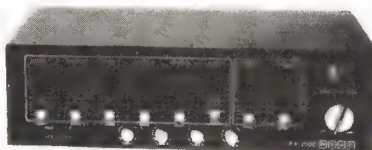


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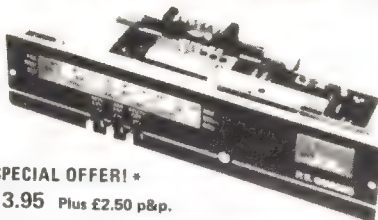
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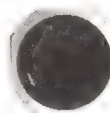
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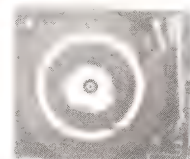
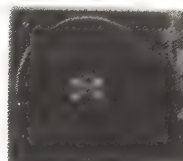
### SPECIFICATIONS:

Max. output power (RMS): 125W. Operating voltage (DC): 50 - 80 max. Loads: 4 - 16 ohms. Frequency response measured @ 100 watts: 25Hz - 20KHz. Sensitivity for 100 watts: 400mV @ 47K. Typical T.H.D. @ 50 watts, 4 ohms: 0.1%. Dimensions: 205 x 90 and 190 x 36 mm.

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# LETTERS to the EDITOR

Do you have an opinion to air? Do you know the answer to something which puzzles, or a tip that might help, fellow enthusiasts? Have you something to add to a feature or review?

Your letters are invaluable in helping us to develop the magazine for you

Write to Letters to the Editor, **Radio & Electronics World**, Sovereign House, Brentwood, Essex CM14 4SE.

## Class

ne magazine. Can we have some DIY  
als? HG V/UHF etc.

**Patchitt, Immingham**

tor's note: The February issue gave  
ails for extending the use of Bever-  
e aerials. We include a constructional  
ject for the 2 metre Tiger in this issue  
d a feature on a J-stick will appear in  
e near future. More later.

## was amazed'

Recently I saw *R & EW* magazine in WH  
miths. Quickly going through the  
ges, I found many items of interest and  
urchased it. At home and reading *Part*  
of the *Amateurs Handbook*, I was  
mazed at the information given.

For four years I have had an SRX 30  
ceiver (shortwave), but just trusted to  
ck what I might receive. Now, from *Part*  
of your *Handbook*, I know what to do  
d where to listen. I am an SWL and now  
el so much more interested.

Is it possible still, to purchase *Parts 1 &*  
of the *Amateurs Handbook*?

I will certainly buy *R & EW* magazine  
ach month in future.

**Plaice, Swansea**

Editor's note: The December 1983, and  
January and February 1984, issues of *R &*  
*W* which contain the *Amateurs Hand-*  
*book* supplements, are available from us  
at £1 each.

## Amplitude modulation transmissions

Arthur Gee, in his column in your  
February edition, says 'and why not AM,  
ou may ask?' in his attack on that  
mode's use on 80 metres. I most certainly  
o ask.

Dismissing the real issue in the single

Please note that we are no  
longer agents for VHF  
Magazine and enquiries  
relating to this publication  
should be directed to:-

VHF Magazine  
UKW — Berichte  
Jahnstrasse 14  
D-8523, Baiersdorf  
West Germany

throw-away word 'overmodulated', not  
referred to again, he criticises amplitude  
modulation for being old, associating  
QRM to the mode itself rather than the  
way it is applied.

As a modulation system AM is indeed  
old, highly successful and undoubtedly  
the most widely used form of modulation  
world-wide below about 50MHz. It is not  
precluded either by licence regulations  
or the UK HF band plans. A correctly set  
up AM transmission, whose spectrum  
(given a well designed modulator) can  
closely approach its theoretical mini-  
mum, is a much more comfortable  
neighbour to have in the next street than  
an SSB station (whose spreading is  
always well beyond the theoretical  
minimum).

Technical arguments aside, the most  
offensive aspect of the attack is the  
almost direct statement that amateurs  
have no right to use AM on 80 metres or  
any other crowded bands. This is a truly  
appalling thing for an amateur of G2UK's  
experience to say.

To refuse a legitimately licensed  
amateur this right, is virtually to forbid  
the newcomer to amateur radio to come

on the air using equipment he has built  
himself. The sophisticated equipment  
needed to compete in the rat-race, which  
this hobby has become, is well beyond  
the capability of most newcomers (and  
many old-timers) to construct and prob-  
ably also to afford.

Most of us started with AM equipment  
and I, for one, benefitted far more from  
that experience than from buying black  
boxes and learning jargon. This is what  
amateur radio is for (according to the  
licence, anyway,) and I welcome the  
news that someone has the originality to  
use it in this way. What on earth are  
things coming to?

If Arthur Gee dislikes things that are  
old, to such an extent, he should perhaps  
be aware that the term Kc/s became  
obsolete nearly 20 years ago.

**A J Henk, Epsom**

I am sorry Mr Henk found my comments  
on amplitude modulation 'offensive'.  
They were certainly not meant to be and  
if he found them so, my apologies to him.  
Apart from that, I agree with the sense of  
his letter, if not the detail. My point was  
that there is a 'time and place' for  
everything, and Sunday morning is not  
the time for amplitude modulation trans-  
missions on the 80 metre band. Any  
beginner trying out his home-built AM  
transmitter then and there, is likely to  
quickly give up amateur radio very  
disillusioned!

He is, of course, quite right about  
'Kc/s'. However, he cannot deny that the  
term has become part of amateur radio's  
jargon and is likely to remain so for a long  
time yet.

I love old things — in the right place. I  
even run a steam launch!

**Arthur C Gee G2UK**

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# ATV on the Air

**Presented by Andy Emmerson, G8PTH**

I heard a story recently which is possibly apocryphal, but it went along the lines that there was a guy at the Radio Regulatory Department whose job was to log and study anomalous propagation conditions ( 'lifts' to you and me). The bottom line was that in the last year there had been more openings than in all the previous years that they had been recording, which in fact was not very long. I have not bothered to check the accuracy of this little tale, but I can certainly say we have been well blessed in 1983. In fact, I knowingly *missed* more openings last year than I have ever worked in the past.

*Returning to the theme of putting slides on video here is a neat gadget from Canon. If you have a lens which will focus down to 1.7cm (0.7in) this DP-10 adaptor will enable you to film 35mm slides. This adaptor will work with the lenses of several cameras (I use one with a JVC G-71 camera) but the somewhat similar adaptor made by Olympus will not*

Why this should be I am not sure. It may be that we are keeping better watch for unusual conditions, or possibly we have more sensitive receivers these days and see more of what's going on. Anyway, I don't think anyone is complaining – not on the ATV front. There are usually a few muffled complaints from 70cm repeater users about strange buzzing on their audio, but fortunately these people tend to stay on their repeaters and dismiss it as atmospherics (sorry folks, only joking!).

What are the signs for a useful lift? Probably not found by monitoring the calling channel, 144.750MHz. This is said

for two reasons, firstly, because of always waiting for the other guy to CQ, and secondly, because the lift does not favour two metres.

An example in point occurred just before Christmas, on December 29th. A local amateur telephoned and asked me if I could identify the 'distorted' picture on 70cm.

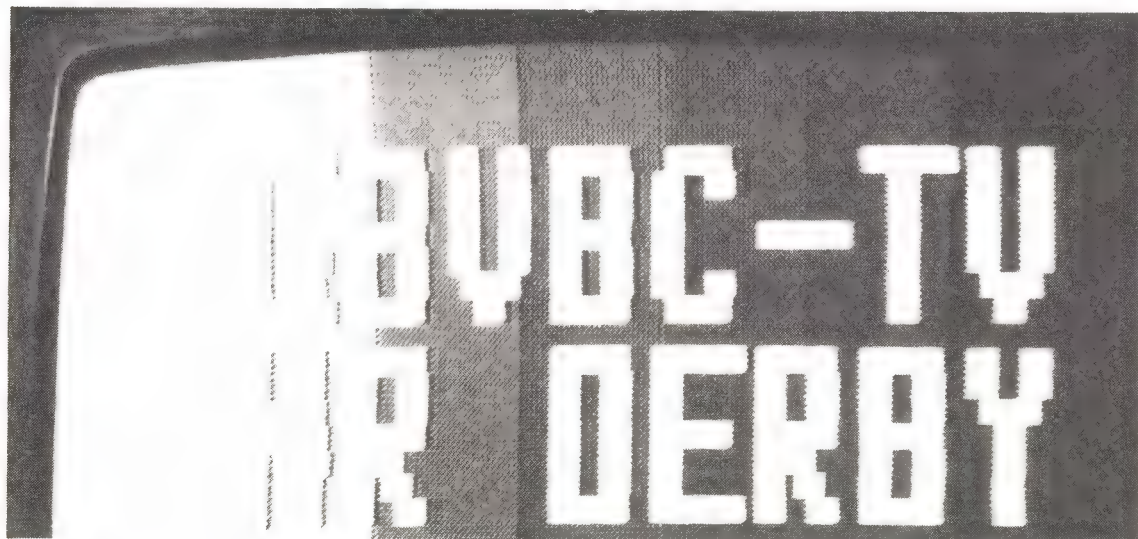
Well, it was F3LP in Le Havre, sending positive modulation (the normal French broadcast standard). But there was French talkback audible on two metres.

## UHF openings

Even more frustrating was when Timms G8VBC later on saw F3LP on 2m with P5 – perfect quality – pictures, up near Derby. But there was no way he could raise F3LP on two metres, and for a number of reasons he was unable to contact F3LP. Rod is now threatening to compile a list of French stations and their telephone numbers, so as not to miss any more two-ways in future!

On the same evening, I heard my first ever QSO on 934MHz, so it is clear that

*This is the test signal radiated by Rod G8VBC, from Woodville, south of Derby. Rod is very active on 24cm as well as 70cm*





## ATV ON THE AIR

ditions favoured the UHF's that thing and not VHF. I think I have marked before about a 70cm TV QSO a Dutch station; grade four pictures not a peep on two metres. We had to port to writing with felt pens on the k of test cards to pass over names and ports!

he safest means of catching UHF nings is, therefore, to monitor UHF. If have a scanning audio receiver it uld be worth putting a distant beacon uency into the memory bank. I tend monitor broadcast TV; if there is ceable patterning on a local or dium distance transmitter I know gs must be lively on 70cm. I live at rthampton and the Channel 4 trans- sions from Sandy Heath are regularly cked out by Antenne 2 from Lille en conditions are good. Another ication is multipath distortion and/or ep fading on a normally good but tant UHF transmitter, also 'freeze mes' on live TV broadcasts. What is ppening here is that the microwave dio-to-transmitter links (STLs) are pping out - e.g. grazing the ground e to bending - and a framstore makes od the instantaneous loss of picture. od fun for us but not for the oprofessionals...

### Video tapes

This column is called ATV on the Air, t I think that many ATVers are also

interested in video as well. So I have no apology to make if I include a bit of video technology now and again. One of the essentials of video is video tape and I was thinking to myself the other day how the price of this stuff has dropped. Remember when some shops charged £12 for a three hour tape? It wasn't so long ago, and in those days there were a lot more 'pirate' brands of blank tape too. Most were pretty poor, some really abominable, and a few were quite good. At least one of the good ones has now gone legitimate and obtained a licence from JVC. With the price of brandname tapes down to £6 for a three hour tape there is no excuse for buying cheap horrors now.

From time to time, though, there are shortages of blank tape and wholesalers are then forced to import tapes originally destined for the USA and Japanese home market. VHS tapes for 525-line countries are prefixed T instead of E (eg T-120) and play on our machines for almost a third longer. This is because our TV field rate is 50Hz rather than their 60Hz, and the tape moves past the record/playback heads at a more leisurely pace in European machines. So a T-120 plays for around 2 hours 40 minutes. These tapes are quite all right to use despite some silly scare stories you might have heard, though the picture quality may be marginally worse. One tends to find that HG or premium grade

T-series tapes are equivalent to our ordinary grade. If you look at some of the prerecorded tapes on sale or rental at your local shop you will discover that some have been put onto T-127 blanks, so they can't be that bad.

You often get more tape than you pay for, which is useful if a TV programme overruns or starts late (BBC-2!). Experience shows that Scotch tapes give you an extra minute, while JVC and Thorn can have up to 5 minutes to spare. The RCA VK-250 tapes are the most generous, offering an extra 10 minutes.

### Survey of video tape users

Not everybody uses the full length of their tape anyway; a survey commissioned by Scotch showed that 55% of users did not use all the time on a tape. A large number wasted 15 or 30 minutes of recording time per cassette. This is probably true; I know I do it myself; usually you can't help it - if a programme lasts 100 minutes you have little option but to use a two hour tape.

The same survey, which was directed at VHS users, purchased only the E-180 length but just 20% bought the E-120 size (film pirates?) and the remaining 15% purchased selectively according to their requirements. I must say that I tend to get only E-180s; they offer better scope for re-recording and cost little more than the E-120 size, often less in fact when they are on special offer.

# CORRECTIONS AND MODS

Whilst every effort is made to minimise errors in diagrams we will correct these as they come to our knowledge and we also appreciate the co-operation of our readers in notifying these.

We occasionally receive suggested modifications from readers who have constructed projects from **Radio & Electronics World** and we will publish those that would interest other readers.

For example, it may be possible to extend the use of a particular item by minor circuit changes or re-arrangement only. If this can be done for minimal cost and the idea has been proved in practice, others may benefit from the information. Write to Corrections and Mods, **Radio & Electronics World**, Sovereign House, Brentwood, Essex, CM14 4SE.

### Oscar-10 (March 1984 issue)

We regret that the computer printout (Figure 5) on the right was omitted from the article.

### 'Direct video interface' (Nov '82) and 'Direct RGB interface' (June '83) projects

We are advised by Mr Warne that the 80VA transformers used on these projects should be monitored for abnormally high working temperatures and replaced by a higher rated (120 VA) transformer if necessary.

Orbital elements for OSCAR 10  
Reference ID= NET 11 December 1983

U.T.C. MM:SS	AZ deg	EL deg	DOPPLER Hz	RANGE Km	HEIGHT Km	LAT deg	LONG deg	PHASE deg
0638:00	148	9	-1864	17258	12276	-13	339	22
0708:00	147	15	-1147	21585	17271	-4	329	33
0738:00	141	28	-1824	25294	21583	8	326	44
0808:00	138	25	-668	28586	25219	4	325	55
0838:00	137	28	-716	31154	28232	7	325	66
0908:00	137	32	-573	33276	38688	18	327	77
0938:00	137	35	-441	34989	32684	12	327	88
1008:00	141	37	-316	36888	34836	14	331	99
1038:00	143	42	-82	37114	35587	18	337	121
1108:00	146	44	32	36997	35567	19	348	132
1138:00	149	46	145	36459	35181	21	342	142
1208:00	153	48	261	35474	34342	22	345	153
1238:00	156	49	388	34888	33839	23	347	164
1308:00	159	49	585	32221	31258	24	348	175
1338:00	161	50	636	29866	28948	25	349	186
1408:00	162	50	777	26991	24891	26	349	197
1438:00	161	50	923	23573	22638	26	346	208
1508:00	156	49	1863	19639	18585	25	341	219
1538:00	148	46	1134	15443	13687	22	331	230
1608:00	136	37	871	12221	8378	13	318	241



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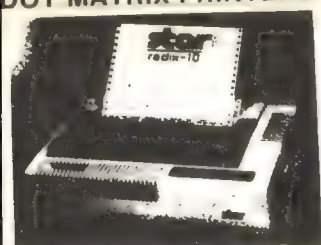
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Speech interface (three fittings)	£30 - VAT	£34
BBC disk manual - formatting disk	£10 - VAT	£11
Parallel printer cable	£15 - VAT	£17
BBC word processor (view)	£52 - VAT	£59
BBC Fourth language cassette	£15 - VAT	£17
BBC Lsp language cassette	£15 - VAT	£17

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# — CLUB NEWS —

## G celebrates Silver

1984, the British Amateur Radio Group (BARG) celebrates its Silver Anniversary. The Group has come a long way since those days in 1948 when a few pioneers got together to exchange ideas about what was then the new technique of amateur RTTY. Today, it caters for most forms of data transmission, ranging from RTTY, AMTOR, FAX, weather forecasting, satellite and telemetry, to the more advanced techniques of digital repeaters, packet radio, computer-to-computer communication, and so on. The BARG Newsletter is published quarterly, and consists of around 60 pages of technical, constructional and theoretical features, together with news and items of general interest. The Newsletter also carries a schedule of the RTTY News Bulletin service, which has recently been expanded. The bulletins are broadcast from stations all over the UK on Sundays on 10m, 2m and 20m. Test transmissions are also radiated regularly, to allow amateurs to check their receiving equipment. Bulletins are transmitted in RTTY at present, but AMTOR and ASCII will be added in the near future.

Another service offered by BARG is the sale of publications and specialist RTTY components. One of the most popular books available is 'RTTY The Easy Way' which describes the equipment required to operate RTTY with full details of terminal units, tone generators, and ancillary equipment, and has been responsible for many amateurs starting in this mode. The book is available from Mr Ian Brothwell, G4EAN, 56 Arnot Hill Road, Arnold, Nottingham, NG5 8LQ, at £1.15 including packing and UK postage.

Current membership is around 1300, and is expected to grow rapidly in the next year as interest in data transmission increases, particularly in the microcomputer field. Membership costs £5 per year, in return for which the member receives the Newsletters, and can take

advantage of discounted prices of publications and components. In addition, several trade suppliers offer discounts to BARG members. A SAE for membership details to: *John Beedie, G6MOK, 161 Tudor Road, Hayes, Middlesex, UB3 2QG. Tel: 01-561 0010*

## Chelmsford Amateur Radio Society

Future meetings planned are—March: Steve Oakman of Marconi Instruments Ltd. April: 'Microcomputers as applied to Amateur Radio' by Arthur G3KPJ. May: 'RF Power Transistors' by Dick G3WHR. June: Constructors Competition. Remember this year there is an extra prize for the first time winner. Details later.

The rally season is fast approaching and several members have enquired as to the possibility of running a coach/minibus to various events. We could run a trip to the RSGB National Amateur Radio Exhibition at the NEC, Birmingham, on 28th or 29th April or the National VHF Convention at Sandown Park Racecourse on 24th March if we have your support. I am starting a list of those interested, so please tell any of the Committee if you would like to go.

The long warm summer days seem a long way off but now is the time the Society must plan for our NFD entries. In addition to our customary HF activity on the 2-3rd June we would like to participate in the VHF activity on the 7-8th July, to give the class B licensees a chance to organise their own fun weekend. Two Committee members have volunteered to coordinate these events:—Dick Brooks G3WHR for HF NFD, and John Donnithorne G8MKX for VHF NFD. Names as soon as possible to these members for the planning groups to be formed.

## Biggin Hill Amateur Radio Club

The Club was founded at the beginning of 1982—one of the results of the Morse classes held in the winter of

1981/82 by Roger Jones (G3YMK) and Jim Burr (G3CTI). There are now over fifty members and we usually meet on the third Tuesday of each month for lectures or demonstrations of interest to licensed amateurs, SWLs, and all those concerned with the technicalities of radio and television. We also arrange sales of surplus equipment, which are always well attended.

To join, let me have a cheque for £5 payable to the BHARC with your name, address, phone number and callsign.

On March 20th we are planning to bring in some test equipment for you to check the performance of your rigs. For April 17th we've invited a Kent dealer to demonstrate his wares, and on May 15th we're planning a talk on ORP operation. Another junk sale is in the diary for June 19th.

The dates for the rest of the year are: July 17th, August 21st, September 18th, October 16th, November 20th and December 18th. Probable subjects include a construction competition, antennas, a live demonstration of RTTY, a DF hunt, and a visit from the leadership of the RSGB.

*Ian Mitchell, Greenway Cottage, Tatsfield, Westerham, TN16 2BT. Tel: 376*

## British Amateur Television Club

The BATC has installed a news 'Hotline' service controlled by a telephone 'answerphone' machine. The programme is updated at least every week or as often as necessary.

Up to the minute news and information will be included as well as essential details about the BATC.

The Hotline is located in Leicester so that it is as close as possible to everyone. The Hotline is open 24-hours a day. Tel: 0533 600108.

The Club is negotiating the acquisition of the use of a number of pages on the PRESTEL data service. As with the Hotline this will carry the very latest news concerned with amateur TV as well as details on the Club itself.

Further details on these services will be included in the next issue of CQ-TV magazine.

## The British Amateur Electronics Club

The BAEC started in Penarth, South Glam, in 1966, is the only national amateur electronics club in the UK. There are now many members from beginners to experts in all age groups all over the country, and also overseas.

The BAEC newsletter is the key to the club's success and is sent to members quarterly. It contains letters and articles covering all aspects of electronics, and the sections Help Wanted, Sales, Exchanges and Requirements are popular. A Members List is circulated so that members can contact other enthusiasts.

The Club has a special responsibility to assist all who are learning about electronics. Help is freely given, and important aids to practical work are available.

The library contains many technical books and electronics magazines, all available to members on loan. The selection includes British and American publications, some of which are difficult to obtain elsewhere. Except for postage, the library service is free for UK members, but special arrangements have to be made for members overseas.

Special concessions have been arranged with well-known suppliers of electronic components and equipment, and free BAEC labels help to obtain good service from these companies.

The BAEC Amateur Electronics Exhibition is held in Penarth annually, and members contribute their electronic projects and games for it.

The Membership fee for UK and Eire members is £5.50 sterling per year, and overseas fees are £7.00 sterling per year for Newsletters to be sent by surface mail, and £8.50 sterling for Newsletters to be sent by airmail outside Europe (£7.00 for Europe). All payments from overseas, including Eire, should be made in sterling. The BAEC year starts on January 1st, and all new members receive all the Newsletters for the year,



regardless of when they join.  
Mr J G Margetts, Hon Sec,  
BAEC, 113 South Road, Hor-  
dean, Hants PO8 0ER.

## Lough Erne Amateur Radio Club

Our club is holding its third Mobile Rally on Sunday 15th April, 1984, at the Killyhevlin Hotel, Enniskillen, starting at noon. The hotel is located on the shores of Lough Erne, hence the name of the club. We are having all the usual trade stands plus a large 'Bring and Buy', all items not sold will be auctioned at the end of the day (with owner's permission of course).

The Hotel is offering an attractive Mini Weekend from £30 per person. We welcome all those interested in radio communications and electronics to come along.

Admission will be £1.00 and full hotel facilities will be available. All the usual attractions - Boat Trips, Pony Rides for the kids, Jaunting Car Trips etc.

## Glenrothes & District Amateur Radio Club

Work on the alterations taking place in the clubrooms is slow due to lack of commitment by club members. Within the clubrooms the main tasks are joiner, electrical and paintwork, along with a general clean out and reorganisation of the facilities. Until all internal work is completed, it is unlikely that work will begin to re-instate the antenna installations on the roof of the clubrooms. If you can spare some time, notify either Jim GM4TNP or Drew GM3YOR, who are co-ordinating the work.

It is hoped to resume work on the 70cm Repeater GB3FE club project as soon as the internal work on the alterations to the clubrooms is completed. If you would like to assist in the work required to complete this project, notify Jim GM4TNP.

An article about the club was carried in both the Dundee Courier & Advertiser and the Glenrothes Gazette in January. Copies of both articles are available to members.

Les Hamilton, GM3ITN, has taken over as QSL manager for all GM series call signs. His address for sending self-addressed, stamped envelopes for the return of cards is

Halls Land, Hardgate,  
Clydebank, Glasgow G81  
6NR.

Dave, VP8AQA, brother of club chairman Jim GM4TNP, who is in Antarctica with the British Antarctic Survey Team, has ceased amateur radio operations prior to his return to Scotland.

Seven operators participated on the club's behalf in the 1984 Affiliated Societies Team Contest. Claimed scores were:

GM3YOR Drew, 1430 points, 143 contacts

GM3OLK Dave, 1290 points, 133 contacts

GM3ZSP Ken, 960 points, 96 contacts

GM4EJI Gavin, 880 points, 88 contacts

GM4SJJ Steve, 730 points, 73 contacts

GM3PFQ John, 550 points, 55 contacts

GM3YBQ Ken, 330 points, 33 contacts

The top five scores will be combined to give the club's score in the contest.

## ARTAC International

ARTAC (Amateur Radio Third Party Action Committee) International is a group of Australian Radio Amateurs who consider it time that a number of countries, especially Commonwealth countries, were encouraged to follow Australia's lead in allowing members of their Amateur Radio Service to use third-party operation, thereby removing a long standing, most unnecessary and highly 'political' strangle-hold on the Amateur Radio Service.

In some countries the third-party restrictions are so severe that it is illegal for members of the Amateur Radio Service who are operating within a legal radio network to relay messages, or even signal reports, to other amateur stations in the net who are having difficulties in receiving certain stations due to interference or poor conditions. It is therefore, illegal for stations under these rules to become involved in International 'DX' nets.

Authorities in many countries are so 'neurotic' about third-party, they insist that under no circumstances shall anyone's voice, except that of the licensed operator, be

# RSGB NATIONAL CONVENTION 1984 NEC, Birmingham PROVISIONAL PROGRAMME SATURDAY 28 APRIL

## ROOM 1

11am and 3.45pm

"An introduction to amateur radio" by the RSGB Education Committee.

2.15pm

Discussion with RAE tutors at which a representative of the C & GI will be present

## ROOM 2

11am-12 noon

A lecture by the RSGB EMC Committee

1pm-3pm

Raynet symposium by the RSGB Raynet Committee

3pm-4pm

"Patterns of hf propagation - or the shape of things to come" by Ray Flavell, G3LTP

## ROOM 3

1pm-2pm

"Introduction to the vhf bands" by the RSGB VHF Committee

2pm-3pm

"Getting the most from your vhf station" by the RSGB VHF Committee

3pm-4pm

"An introduction to microwaves" by Charlie Suckling, G3WDG

## HF CONVENTION (Pendigo Suite)

12 noon

"Operating as a dxpedition" by the RSGB HF Committee

1pm

"Linear amplifiers" by Peter Chadwick, G3RZP

2pm

Home-constructors forum. Talks by members of the G-QRP Club. Panel of experienced constructors and writers. Chaired by Rev George Dobbs, G3RJV

3.30pm

Presentation of hf awards and trophies

4pm

HF forum. Panel of members of the RSGB HF and HF Contests Committees, chaired by the Society's hf manager, John Allaway, G3FKM

## SUNDAY 29 APRIL

### ROOM 1

Two one-hour sessions commencing at 11.15am and 2.15pm for the beginner: "An introduction to amateur radio" by the RSGB Education Committee.

### ROOM 2

11am-12 noon

"Aspects of propagation studies as they affect the radio amateur" by Ray Cracknell, G2AHU

1pm-3pm

Raynet symposium by the RSGB Raynet Committee

3pm-4pm

A lecture by the RSGB EMC Committee

### ROOM 3

1pm-2pm

"Introduction to the vhf bands" by the RSGB VHF Committee

2pm-3pm

"Getting the most from your vhf station" by the RSGB VHF Committee

3pm-4pm

"An introduction to microwaves" by Charlie Suckling, G3WDG



## CLUB NEWS

ayed over the air. This action is so severe that licensee of the station expect to receive angement notification the authorities for hav- s microphone gain set a too high, thereby allow- unlicensed background s and voices to be mitted.

ese restrictions are necessary and insulting to Amateur Radio Service n is a responsible nisation. Members are ys ready and willing to de their skills and equip- free of charge for the fit of the community and, nationally, the Amateur o Service provides one of stabilizing factors for d peace, breaking down ical, racial and prejudi- barriers.

### BATH & DISTRICT AMATEUR RADIO CLUB

The Club will hold its AGM Wednesday, 18th April, at 7.30. The venue is The Englishcombe Inn, Englishcombe Lane, Bath.



For further details, please contact:-

Colin Ashley (PRO) on Frome 63939 or Mike Mason (Sec) on Bath 311046.  
**C D Ashley G4UMN (PRO)**

### MARCONI AMATEUR RADIO CLUB

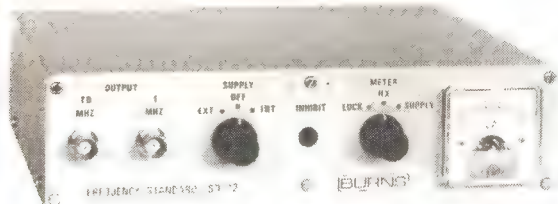
The club will be participating in the 'D' Day Reunion 40th Anniversary in June and will operate three Stations for the first event on the

weekend of 3 - 4 June.

1. GBI MAR. operating from Southsea Common during the WWII Veteran Vehicle Display. VHF Station.
2. GB2 MAR. operating from Fort Widley HF Station.
3. F0???. operating from Normandy Beach-head with G6APD/G4RTT/G6IZN supported by F6FLB and local French amateurs. VHF station.
4. All these calls will count five points for Basic 'Mary Rose' award, the Basic requirement remaining the same. For those holding the award all count five points for 50/100 Endorsement Stickers. These stickers in silver or gold respectively, are in the form of a Tudor Rose.

The stations will be operating for the 28 day period, with the possible exception of the F0???. There will be special GSL's to commemorate the operation in tour modes, Army Navy & Airforce. A display of WWII communication equipment will be on show. Enquiries to:-  
**V G Scambell Cosham 373099**

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The BBC expect to change this Transmitter Frequency to 198 KHz. Conversion of SD-12 will be simple — necessary circuitry already built-in and replacement crystals supplied with original purchase. Output at 10MHz and 1MHz accuracy 0.1 Hz in 10 MHz

Suitable for calibration purposes (eg using internal battery) or continuous drive (with separate mains PSU) IE as a source of distribution within a laboratory-work shop.

Used by British Telecommunications and other authorities.

We still supply matching crystal calibrators CC-11 and Absorption wavemeters TC-101 as previously advertised.

Contact us at our new address:-

**BURNS ELECTRONICS**  
170a, Oval Rd, Croydon, Surrey CR0 6BN  
Telephone 01-680 1585

## HAVE YOU THOUGHT OF BECOMING AN AUTHOR?

We are always interested in receiving articles to be considered for publication and are particularly keen to hear from anyone who has something to say related to the amateur radio field. As mentioned before, projects for fellow readers to build are most welcome.

You don't need to be an expert writer. If you can get your ideas down on paper, preferably typed, with drawings that we can follow and photographs where relevant, we will sort out the style, grammar, spelling etc.

If you have an idea for an article, or have designed and built a project that you think others would be interested in, but still have doubts about becoming an author, why not write (giving brief details and your telephone number) or telephone Dennis Hayes... and of course you will be paid for your effort.



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- Complete 2 metre station. Ideal as a first rig or a portable station. Standard C146A, 2W handheld, 5 channels, 8 xstals, auto/manual toneburst, 1/4 wave and helical aerials, external miniature microphone, leather case, new nicads, base station unit and charger £90 ono for the complete station. G A Trickey (G4CDW), 11 Pheasant Way, Beeches Park, Cirencester, Glos GL7 1BJ. Tel: 0285 2036.
- Large office duplicator and postcard printer, complete with both red and black drums. Suit club £65. Tel: Horley 2210.
- Standard C8800 2mFM RX/TX rig, unmarked, with s/mount for mobile use, 10W output, LED signal meter, scan and memo for sale £200. Also FRG 7000 in very good condition, with handbook. Both can be seen working £200. Tel: Braintree, Essex 47631.
- 10GHz mixer diodes (1N4146) in original packing, 220pF NP0 ceramic chip capacitors, 5K sub-min pots, complete slow motion drive for Eddystone receiver, asstd RF power transistors, plus lots of other goodies. Contact G8URG, QTHR, or Tel: Canvey 682149 evenings, Phil Ridgeon.
- Barlow Wadley XCR30, XTAL controlled, general coverage communications receiver, as new £40 ono. Tandy TRS80 model 1, level 2, 16K, with monitor and cassette £150 ono. Tandy pocket TRS80 with cassette adaptor £50 ono. Mr M J Turner, 5 Robinson Rd, Hill Head, Fareham, Hants PO14 2DG. Tel: Stubbington 0329 664965.
- Oric 48K Micro, manuals, software etc. Wish to swap for oscilloscope, preferably dual beam but accuracy more important. Dave Churchward, 76 Medway, Crowborough, East Sussex TN6 2DW. Tel: Crowborough 63910.
- Clearout. Tons of new components - ICs, transistors, TV1 filters for TV's £2. Various general purpose loudspeakers, mains suppression filter £2. Various metal project boxes, large electrolytics, ferrite cores, assortment of valves, transformers. Telephone for details. Everything must go. No callers, please. Tel: 01 500 6022 or write, Phil Neville, 66 Oak Lodge Ave, Chigwell, Essex IG7 5HZ.
- Cavity wave meter to cover 2mts 70cms 23cm co-axial relay kit. Full instructions supplied. Twin and single paddle keys. For more information, write: P Sergeant, 6 Gurney Close, Costessey, Norwich. Tel: 0603 747782.
- 16 off MK4096P 4K Dynamic rams £7. 16 off 4116-2N 16K Dynamic rams £12. Thumbwheel decade switches with BCD outputs, one off 4-Bank £2.50. 8amp cut-out £1.50. Prices include postage. Mr Dixon, Kyrles Cross, Peterstow, Ross-on-Wye, Herefs. HR9 6LD.
- Belcom transceiver mobile 26.00MHz-29.99MHz multi-mode £188 no offers. Tel: 0734 883418 after 8pm.
- Belcom LS102L 10-11metres transceiver, multi-mode mobile £188. Tel: 0734 883418 after 8pm.
- Pye PF70 UHF Pocket-Fone, single channel with Ni-Cad, leather carrying case and crystals for RB6, unmodified 500mw output £40. TVI 27MHz RX filters £2. Tel: 0273 516801 (Newhaven).
- Yaesu 902DM, mint condition, original box, hardly used £600. Tel: 01 890 4666.
- CB Radio, Havard 420M, 40 channels FM, with power mike £38. Tel: 0734 883418 after 8pm.
- Spectrum beep £6, amplifier plus radio (MW+LW) plus better saving and loading. Spectrum Morse program. Tel: Kilbarchan 2288 David, or write JAVED, 2 Tandlehill Rd, Kilbarchan, Renfrewshire PA10 2DQ.
- Antique 2-way battery telephone, General Electric Co, Coventry. Brown bakelite hand pieces, with wooden box, bases and brass phone-hangers, also wiring instructions. Very old. Would consider exchange for UHF receiver covering marine bands, or ATU or WHY? Write with details for exchange only. All letters answered. Mr Marsden, 205 Moss Lane, Burscough, Ormskirk, Lancs L40 4AS.
- Shack clearout. Two metre, 70cm Air-band and test gear must go. Components and accessories, books and mags (1800 to present day). Very good prices. Phone for full lists. Steve Whitt. Tel: 0473 642635 (days), 0473 54405 (evenings).
- Creed 7B/RP and 6S6 tape recorder. Both perfect working order. Complete with full Creed maintenance manuals. Also details from Comput-

ing Today on using above as a computer printer. Offers please. Buyer collect or haggle on delivery. Tel: 0543 472054.

- Tandy DX302 general coverage receiver, 30 bands digital readout. As new condition. Original packing. Surplus to requirements. First sensible offer secures. Also have 8 element 2 metre Jaybeam and Araki 2 metre 3/4wave GP Co linear. Offers for any or all of above. SAE or phone for further details. J Peerless (G3JPJ), 157 Fairmead Crescent, Edgware, Middlesex. Tel: 01 958 6887.
- Stalker ST-9FDX-10W AM/FM 20W-USB ILSB-320FCC channels plus all 27MHz UK FM channels. Owner now licensed amateur. Boxed and in excellent condition £80. Also contra CP-163X HF Linear amplifier plus preamp input 0.5W/5W/10W. Output 20/50/100W. AM/FM, 40/100/200W SSB power supply 13 8Vdc. Suitable for mobile use. Frequency range 3-30MHz £80. Tel: 0789 295915.
- Pye 'International', 11 waveband. High performance receiver. 11m to 2000m. Perfect £30. Vidor battery eliminator 90V HT, 1.5V LT for valve portables £10. Pye Vanguard AM 25/B High band radio-telephone, mint £25. Admiralty wavemeter G56 (15KHz to 24MHz) with new calibration curves £20. VCR 131 Electrostatic CRT (12in version of VCR 97) £10. Collection of 1922-1939 wireless magazines. Send for list. K W Clark (G3WIF), 16 Goldney Rd, Clifton, Bristol. Tel: 0272 293738.
- Brazenose stereo h/phone/speaker or both, junction box £2.50. Three pairs plastic tweezers 50p. RAE manual by Benbow, 10th edition, 1982/85 syllabus £2. Electronics Digest, volumes 2 and 4, mint £1.50. Service manual for Phillips B & W video LDL1000/LDL1002 £3.50. Reel tape, spare spool for LDL1000/2 £1.50. P W Hall, 38 Old Hall Rd, Tingley, Nr Wakefield, West Yorks WF3 1QE. Tel: 0532 524108.
- Once used reel to reel computer tapes, 7 1/2ins. Will record over easily. About 30 in all. Most boxed. Good condition. Will sell separately. Offers to Kevin Gray, West Lodge, Carruth Estate, Bridge of Weir, Renfrewshire PA11 3SG. Tel: Kilmaccolm 050587 2169.
- York CB transceiver JCB863 complete with aerial PA, speaker instruction manual etc. Would swap for any home computer, any condition considered, with or without cash adjustment. Tel: Bourne 0778 424029.
- ZX81 with 16K RAM, full size keyboard, progs, books etc £45 ono. Yashica TL electro SLR camera with many extras, four lenses £150 ono. Full colour darkroom outfit, enlarger drums tanks etc £125 ono. SX200 Scanner £150 ono. Consider swap any of above for FT208 or any 70cm gear. Dave (GW6UGD). Tel: 0222 733885.
- Journals RSGB radio 'Com' good condition. 1978 and '79 to '83. 12 copies each. Offers please. Buyer collect. Tel: Southend 68254.
- Two Meter multi-palm II Transceiver, six channel. R0, R6, 14, 19, 20, 22, Ni-Cads and charger £50. Heathkit linear HA202 50W 12V £45. 10m linear, new, unused 140W SSB. 240V AC input £69. Maxcom 7E as new, in case, 4W including mag mount £45, as new. Tel: 0872 862575.
- 144MHz 2m linear amplifier, with integral PSU and coding £95. 2m 10-element Yagi £12. Tel: 0733 232769.
- Heathkit GR-78 receiver, R209 receiver, Windsor 30A oscilloscope, AVO signal generator type III 150KHz-220MHz, realistic PRO-20A 4-channel 68-88 144-174MHz pocket scanner, Antex precision de-soldering iron. Sensible offers. Tel: 06333 74227.
- Eddystone RX 840A. Very good order, very seldom used £60. Bargain. Mr A R Roxbee, 25 Toms Croft, Turners Hill, Hemel Hempstead, Herts HP2 4LL. Tel: 0442 66968.
- Swan Astro 200 digital broad band Transceiver. Complete ACPU manual 80-10 metres. Full scanning. Very good condition £250. PKW trap dipole 80-10 metres, complete, as new £20. Mrs D Haslam, 3 Meadow Crescent, Carlton, Blackpool. Tel: 0253 885234.
- CB TX/RX. Lafayette 1200FM. 120 channel. LSB USB FM AM PA switch. Instruction book, Circuit diagram. Good condition, in box £45. Buyer pays carriage. Tel: 051 355 9325.
- Two portable 'listening' cassette with headphones, talk-in button case, almost unused £24

- ono. Also soldering gun, Weller, with tips, Also 'unused' £16 ono. Mr Dave Evans, Summerhill Rd, Onchan, Isle of Man. Tel: 06 924 1111.
- New, unused DC lead for FT101 MK1 Tandy CB home base TRC 3000, 3 months new, boxed £55. Tandy 40ch portable, TRC 1 No offers. GM4DHJ QTHR. Tel: 041 889 90.
- Trio TR9130 multimode, PS30 20Amp PSU system base, very good condition £470 ono. Trio official service manual for TR9130 a SQY08 8-Elc Quagi £25 ono. Tel: 021 378 420 6pm.
- VHF 10-channel scanner crystalized repeaters and 145.800, 145.500 as in catalogue, cost £56, accept £30 ono. Also charger for above included. G4SZ1. Tel: V 7194 evenings.
- Trio 2300 including Ni-Cads and s purpose 5amp PSU and charger £145 ono. sell as separate items or consider part exc for FT 107 memory board. Write or phone Hazlewood, 16 Richmond Grove, Wollaston, bridge, West Mids DY8 4SF. Tel: 03843 (G4KZB).
- FT708R 70cm hand-held, in original box two Ni-Cads, NC9C charger £175. Pye F450L Base station on RB12 £25. 10metre FM Icon repeater shift and display modification G3XVL. Chris McCarthy. Tel: Chesham 0494 7.
- Three direct-drive record decks, su spares £5 lot. Micropeus floppy disk controller board £20. UK101 16K and extra ASC11 encoded keyboard £10. SEW VU m professional, 6in scales, brand new, ori packing, offers? 10Kg scrap electronic chass post paid. Microsecond chronometer, circa (massive case) £10, buyer collects. Hugh Br 363 Kennington Lane, Vauxhall, London SE11 Tel: 01 735 1862.
- Collector's item. Several early post war ra All cheap to clear. Space needed. P W H Gordon Rd, Chandlers Ford, Eastleigh, Hants, 1AN Tel: 04215 3920
- Teletype model 33 with stand, tape pu reader, dust cover, set manuals, £20. B collects. Chris Marshall Tel: Witney 4867
- Labgear aerial. AMP group C/D inc PSU (16 year old. Offers Tel: Dursley 0453 842238 (e ings)
- Murphy B40D communication receiver. Buyer collects. 16MM Filmosound projec excellent order £90. Would exchange for 2 m 100W linear MM with pre-amp. Tel: 0903 66329
- HB9CV 70cm antenna + clamp £4. MM 70 receive converter £15. Heathkit IG4505 sc calibrator and manual £10. TR10 MC50 desk m £15. Collect or could deliver North London are Van Walwyk, 11 Valette Court, 75 St James La London. N10 3RA
- Circa WWII private collection. All good con. TX/RX ZC1. TX.36 set with PSU RX BC34 Also CRT. Cossor 85K-15in CRT. 901GEC lifeb SOS-TX + auto keyer. Rees Mace retireme Limited space dictates disposal. Will accept £ the lot. Buyer collects. No splitting please. T 0543 490078
- Early television tubes, Mullard, Mazda A47, A CME 7 for £5. 12in CME1201 A31 Mazda, Gene Electric 10 1/2in TSD217, £2 each. Buyer collec Two old Garrard auto-record changers RC1 MK11. Offers. Tuning condensers, air spac mixed values spindles and preset, 500PF twin. Tel for £5. Edwards, 244 Ballards Lane, North Finchie London, N12 OEP Tel: 01-445 4321
- Sony VP-1000 low band U-matic player cor plete with handbook. New heads fitted recentl £250. Would exchange for 2mtr multi mode bas station TS700 or similar. Write Mr Bushnell, Grange Close, Fyfield, Andover, Hants. SP11 8DX Tel: Weyhill 3141
- Compucolor II computer. 8080 Processor, 16 BASIC and 32k memory, with integral 5.25ins dis and colour monitor. Plug-in 117 key keyboard Absolutely complete system. Looks like a attractive 13ins TV set. Lots of programs including amateur radio contest scoring/printing etc. With service and programming manual and many relevan books. £499 complete. Creed teleprinters, tape punches and readers, and spares. Mostly working Offers? Tel: Smallfield 3545.



# FREE READERS SMALL ADS

## FOR SALE

RAF Wop-Air 1944 wishes to consider your hobby and offers £300 of Trix OO gauge railway in best condition for beginner's type or transceiver and necessary instructional and assoc. equipment. Jack McMillan, Drumbrae Walk, Edinburgh. EH4 8DQ.

Like R4C/T4XC separates, AC4, M54, 6, 1.5, 0.5 filters, extra xtals, v.g.c. £550 ono. MFJ master memory keyer, 12 memories, auto, excellent contest keyer £65 ono. J Wayman (S), 190 Drove Road, Biggleswade, Beds. HP. Tel: Biggleswade 312609 (evenings)

Yaesu FT290, 2metre multimode rig with tuning case, nicads and battery charger. As new Microwave modules 30 watt linear amplifier will part exchange for solid state H.F. mobile or coverage receiver. Tel: Grimsby (0472)

ans fms isolation double wound. Ex ITT 240V in, 240V out - £10. 3kW ditto. £28. Can be S.E.8 only. Mr L Milton, Fairlight Cottage, Fairlight Rd, Fairlight, E/Sussex. TN35 4AG. Tel: 03392

Yaesu FRG 7700 receiver. FRA 7700 active antenna. Both boxed, hardly used, and in mint condition £230 ono. Or exch for RS232 Modem for £100 + cash. Phone Newport Pagnell 0908 01 (after 6 and weekends).

OW ATU for 160-10M. Unused £15. Electrolytics 100V, 25p. Ambit 25W linear £25 ono. Brand MM144/100LS 100W linear, unwanted gift £130. Westminster mid-band £15. Send SAE for list and back clearout. G8WXX QTHR. H M Field, 6 Wadbury Close, Winsford, Cheshire. CW7 1NA 06065 52834

Scope, Heath kit OS2 3in. Good working order ono. Tel: 06333 73048

Ultra small, high sensitivity, FM RX size 10 x 6 x 1cm. 0.9 Microvolts sensitivity. 100-120 MHz. Accurate tuning, professional monitor WBFM type. New Philips IC to give excellent performance. £54. G3PCN. Tel: 01-866-3300

Valves DA100. New, G.E.C. Boxed. Offers. 50W and 100W valve sets. 50W re-entry 25W speaker, new. Offers. 01-524-01

16K ZX81 DK Tronics keyboard, Qsave inverse code, over £70 software books and spares. Will sell swap for good SWR/PWR meter, WHY? Trio 130 hardly used. Will swap for VHF multi-mode sell. 10M FM 6W rig new £35. Log books £2 inc P. SAE with all queries. No sensible offers refused. Martyn Bolt, 112 Leeds Road, Mirfield, West Yorks. WF14 0JE Tel: 0924 495916

Motorola Design 5 IVE 68705 single chip micro-computer. Designer's kit. Contains nine special chips including 68705P3L micro-computer, A to D, timer, Ram etc. All data sheets, circuit diagrams and Motorola software. Unused competition prize but owner too busy to build kit. Cost £604. Asking £45 ono. Your only chance of your own powerful homebrew micro at such a low price. R Swale, 616 Reading Road, Winnersh, Berkshire. RG11 5HE Tel: (0734) 784035

11 meter linear amp. Ham intern. LA60 multimode, 100W, SSB £35. Mobile aerial 7 foot firestick with boot-mount £7.50. Mr Rolf, 282 Hyde End Rd, Spencers Wood. Tel: Reading 0734 883418 (after 6pm).

Eddystone 5 band midget communications receiver type S870A, 130KHz-24MHz perfect £38. Tel: 01-902 6437

Collaro Conquest 4-speed autochange unit. Collard 3-speed, 3 motor, tape deck. Mains XFR, C.R.T. for Solartron CD1014 oscilloscope. Various Cossor four inch D.B. CRT for 1045 etc. Marconi 600 OHM attenuator. Offers to C Cooper, 11 Radical Ride, Wokingham, Berks. Tel: 0734 734312

Drake R4B recently revalued, crystallised nine bands, all of 10M. T4X with top band Xtal. AC4 PSU rebuilt 1983. MS4 speaker, MN4 A.T.U. £295. 2m Trio TR7010, SSB/CW, with linked VFO700S giving coverage 144-145 MHz. R&EW pre-amp fitted £140. GM4IAO (ex GM8OVN). QTHR. Tel: (0466) 2673 evenings.

Icom IC-720A full gen. cov. TX/RX, used little, orig. packing, mint cond, (£949 new), £725 ono. Can deliver at half cost of petrol. Please write to S.

Langlois, GJ40DX, Merchant Navy College, Greenhithe, Kent DA9 9NY. All replies answered.

Goodman speakers, 15 OHM uncased stereo, bass AX10M 201 twelve inch twin cone, Midax, Trebax. All six speakers plus cross over units, XO5000 XO950, switch attenuator, wool packing, £25, will haggle. Voice operated transmit switch CBE-2003 Sirtel with mobile Electret boom mike. £30 or near offer. Buyer collects. Tel: Hertford 56164

Welson-Syntex Comp with FAL 500 watts 15in speakers, Bass, £300 ono or swap for H/F equipment, Yaesu FT101, FT902, FT707, FT7 or Cobra 148 GTL-DX, late version, with PLL MC145106 IC. Tel: Mr Thompson 01 575 1167 (after 12 noon)

MMT 432/144R transverter 2m input, 10W output on 70cm, 1.6 shift. Standard attenuator suits 10W 2m rigs plus 7dB attenuator to suit FT290R etc (£14.50 list). Lack of spare time forces sale, £140 ono. Also Packer WM7, 70cms wave meter with 70cm helical fitted, £15 ono or free with transverter. Both only six months old. Would exchange for anything interesting. Dino Bragoli, 12 Lynton Mead, Totteridge, London N20 8DJ Tel: 01-446 4932

Icom R70 receiver unused and boxed, £420. Tel: Richard (0223) 312624

AM SSB CB and 28MHz transceivers at keen prices. Also 2nd hand CB rigs and accessories. Contact Sean McAteer, 82 Woodlands, Gilford, Craigavon, Co. Armagh, BT63 6JP. Tel: 0762 831569

Icom IC-25E 144MHz FM 25Watts twin VFO, memory channels, orig. packing, handbook, mobile bracket etc. £210 ono. Also, 13.8V 5A/7A PSU £10. Or both for £215. Please write to Miss E Lawrence, G6TPD, 11 Mabel Road, Hextable, Swanley, Kent, BR8 7SH. Can deliver within 40 miles

Printer 101 Centronics matrix with CBM Pet interface £80. Modems 2200, Racal Milgo 1200 or 2400 B.P.S. B.T. approved £30ea or £50 pair. Keyboard enclosed alloy case. 76 Keys ideal for use with ZX81 or other micro/rtty uses £6. Tel: Ralph (G4PEY). Horsham (0403) 69835

VHF/UHF AM/FM 12 channel scanning receiver. Optiscan SBE. 12m 12V/240V covers 30-50, 68-88, 150-170, 450-470 MHz. SR9 VHF/FM, VFO tuning, 146-152 MHz plus 11 fixed channels. Ten marine bands fitted. £45 ono. I M Tasker. Tel: Grantham 0476 860421

Sir Douglas Hall offers modification or development details of 13 of his constructional designs appearing in volumes 27 onwards of Radio and Electronics Constructor for 25p and S.A.E. He will also reply free to requests for advice, not involving circuit modifications, about any of his designs published in that magazine, but please send S.A.E. Douglas Hall, Barnford, Ringmore, Kingsbridge, Devon

Elector teletext boards plus keypad. All full spec devices used. Cost £90. Bargain at £45. Also Pye teletext board similar to elector circuit, IC's alone would cost £45+. Bargain at £20. CCT board believed to be Prestel. No data. Hence £5. Mr Winwood (G4GPF), 132 Shakespear Crescent, Hallowes, Dronfield, Derbyshire S18 6ND Tel: 0246 410057

Sony ICF 2001 FM 76MHz 108MHz. AM 150kHz 29999kHz mains unit. Maker's packing. Offers or part exchange offers. Tel: Bradford 676556 (after 6pm)

Yaesu FT221R fitted with Mutek front end and complete with h/book and mike £275. Also for family of the late G8WXX MM144/100 (no preamp), MM144/432 transverter (unused). Offers please to G3CBW QTHR. Tel: 0228 39291

Yaesu FRV7700 Model F converter. Little used. Under guarantee £55 ono. Thompson Leitholm, Tunstead Rd, Hoveton, Norwich. Tel: Wroxham 2109

Nascom 2, 48K ram, NAS-SYS3 Zeap, NAS-DIS/Dee Bug graphics, parallel printer, cable, £250. Tel: Ian 08725 2121

Collins KWM 380 HF transceiver general coverage on receive. Extra CW filters £15 ono. Yaesu FT225 RD with Mutek Board - offers. Trio/Kenwood 2kW linear TL922 £450. Yaesu FT77 £375. Atlas 180/215. Tel: David Cole 01-594-3495

(office hours).

Exchange Icom IC-25E 25W 2m FM transceiver, mint condition, mobile mounting bracket etc. For good condition SX200W scanning receiver. Ian. Tel: Shephed (Leics) 0509 502989.

Racal RA17L communications receiver. 5-30MHz. Excellent condition with handbook £165. Bob. Tel: 0953 604019.

Eddystone 730/4 Gen. cov. receiver, good condition £80. Tel: 058 083 326 (evenings).

Tungar 50V 6amp Tapped charger. PSU rack mounting. Ex WD geiger counter. Obsolete valves new. Meters 0-50 microns. 0-10 microns. 0-20 amps M/iron. 0-1 M/iron 0.200V cased. Others. Large vintage round panel meters Volts amps. All very cheap. Blackburn, 57 Friern Watch Avenue, Nth Finchley, London N12 9NY.

Yaesu FC 102 Antenna tuner £130. TONO 9000E communications terminal RTTY ASCII CW Word processor etc. £500. Middleton, 49 Wolseley Road, Stafford, ST16 3XW.

Have Baker research microscope, Mechanical stage binocular eyepiece, camera, very complete outfit. Worth £350. Also Bronica 'C' camera and accessories. Exchange for CB base station complete, RTTY/CW reader terminal, VHF scanner, multi-system TV for DX-ing. Cash adjustment if necessary or will sell. Computer and VDU rig acceptable as RTTY/CW terminal. Tel: Trowbridge 61482 (Wiltshire).

Canon 110ED, flash, leather case £40. Minox B £45. Polaroid 350, portrait kit 581A, flash gun 268 £95. Audio/Visual IFR training course, FAA approved, manuals, projector, player £100 cost £400. SM-D100 stereo mic £15. Philips ultrasonic burglar alarm £10. Ameco (USA) tuneable pre-amp 1.8-54 MHz, 240V £15. FT101, unmodified £200. Woodpecker blanker AEA WB1A £40. SX200N scanner RX £175. FT101 Workshop manual £15. May, Upper Durford, Petersfield, Hants GU31 5AN. Tel: Liss 2143.

Tonna 17 element 2m new £33. Jaybeam 14 element parabeam new £45. Hameg 10MHz oscilloscope, hardly used £130. Icom IC2E modified USA £125. Halbar 6-element quad 70cms new, £10. Part built G4DHF transverter £25. Plus other bits and pieces from shack clearout. Ken. (GAUQN). Tel: 0945 61029.

New CR 2021 Uniden world radio. Offers or will consider part exchange Marine radio R1000 etc. Tel: 0274 676556 (after 6pm).

IC280E 2m mobile FM with remote mounting kit, 3 memory channels £120 ono. G4TAW. Tel: 0689 30334.

Yaesu FT227R 2m FM mobile, plus 3/4 whip, Magmount. 8ELE Yagi and download, SWR-25 Meter, base station colinear plus pole and download, RSGB VHF/UHF manual £150. Also Heathkit GR-64 HF receiver (valves), recently rebuilt and professionally realigned, £35. With original manual. Jim Cook, Jars Cottage, Charlton, Worcs WR10 3LE. Tel: Evesham 0386 860120.

Yaesu FT101Z, FM, 9-band, fan, desk mic. Spare (new) tubes, immaculate condition £400. SEM transmatch with top band and fitted easitune, as new £65. Scarab ZX81 RTTY cassette, plus built PCB £10. N M Lister, G4LVP, 42 Strathmore Avenue, Hitchin, Herts. Tel: Hitchin 58728.

Collectors' items, several early post-war radios, a few pre-war. All types. All cheap to clear, space needed. Pat Hill, 24 Gordon Road, Chandlers Ford, Hants SO5 1AN. Tel: 04215 3920.

Sony ICF2001 keyboard entry receiver, perfect condition, boxed as new, with full instruction book £99 ovno. A. Dermont (686GT), Burghfield Common, Berks. Tel: 073 529 2592 anytime.

Two RS C-jon rechargeable batteries, 2V 25 AH, almost new £7.50 each. For dismantling: emergency lamp units with transformer, rectifier and dropper resistor £1 each unit. Hawken. 0865 67907 (Oxford) after 6.30pm.

48K Lynx colour micro, as new, under guarantee, with compatible cassette recorder £190 ono. L Potts, Smithys Halt, Popes Hill, Newnham, Glos. GL14 1LD. Tel: Westbury-on-Severn 467.

Morse programme for VIC-20, sends random letters and numbers, speeds 1 wpm upwards, will get you your class A Licence £3. Roden, 126 High Street, Lye, Nr Stourbridge, West Midlands.



# FREE READERS SMALL ADS

## FOR SALE

● Early transistor car radio audio amplifiers, with AD140 or similar plus transformer, capacitors £1.50 each. Collins 20W modulation transformer £2. Mains transformer, output 215-0-215V, 100mA, ex-WD. Two 4V 6A 4V 2.75A, 11V 2.5A 2V-0-2V 1A £5. 'Belling' flex lead suppressor for vacuum cleaner fan £3. 'Belling' radio interference filter, cased, 2A £5. 'TCC' high pass television aerial filter £4. Transformer, 10Amp 3.5-40-0-40-3.5V, 240V £5. Alan (G3MBL), 244 Ballards Lane, London N12 0EP. Tel: 01 445 4321.

● 70301 brand new, but dusty because original packing missing. Complete with all cables and handbook. Prefer buyer collect, but could deliver 50 miles Slough, £120 ono. Teletype S52 scope identical X-Y amps, fitted orange filter for long persistence screen, ideal for slow scan TV, or change filter to blue for Standard scope DC, 3MHz complete with handbook £35 ono. (G4CRW), Slough. Tel: 0753 42301.

● Yaesu FT 200 SSB transceiver, with matching PSU and speaker, in superb condition £230. Tel: Wolverhampton 750497 (daytime).

● Maranz C-205 portable professional cassette recorder £60. Also realistic 5ch Stereo mixer with preface, plus mains PSU £25. All in good working condition. Will exchange both for 2mte or 70cms Synth hand hold, or 2m Synth rig 25W output Icom Yaesu or Trio. Mr V J Bobin, Flat 6, No 11 Hyde Road, Eastbourne, Sussex.

● Rascal R17L HF receiver £285. Eddystone 840C HF receiver £75. Redifon VHF radio telephone £110. Large desk radio console £100. All ono. Henry Howard, 108 Lindenthorpe Road, Broadstairs, Kent. Tel: 0843 601041.

● I have a full colour and sound home computer with brand new Sharp cassette recorder, and all books. Make is Mattel 'Aquarius'. Will swap for 2m or 70cm TX/RX with perhaps £10 offered on top. Will collect within 30 miles of Manchester. Martin. Tel: 061 795 5025.

● Large quantity of Electronic and Mechanical components - cheap. Send SAE for list to: M Black, 11 Moorland Avenue, Crumpsall, Manchester M8 6WT.

● B2 Spy set, mint condition, in original suitcase. All coils, crystals, key spares, in full working order. No mods of any sort. Also handbook. Best offer over £150, plus carriage. Tel: 0432 267876.

● Private station, has two 807 units, home brew, (PSU's fault), plus some 6/7MHz Xtals £35 ovno each. Have Phonic's five channel mixer model SM-3000 £15 ovno plus IT'S 9-Volt PSU. Calling Trio R-1000 owners - what offers for SP-100 speaker cost £26. Power problem 'Valradio' transverter 6Volt input, 20 watts, 240Volt output. Also National half track stereo open reel tpe/rec'der plus tapes, speeds 4.75 cm19. Mike Evans, 41 Great Auther House, London EC1. Tel: 01 251 4950.

● Disco lighting kit, still in box. 3-channel sound to light, professional model with auto level controls. 1Kw per channel with zero voltage switching. Similar to Pulsar zero 2250. Kit cost £40 will sell for £21. Also hy-gain five 480 channel CB, excellent condition £75 for quick sale. Brand new push button, American type phone, with last number redial facility. Cost £30 unwanted gift, will sell for £20. Steve. Tel: Sunderland 0783 282057.

● Ultrasonic cleaning machine by ICI. Costs new around £1,000, for sale at £175 ono. Tel: Abersoch 075 881 2845 (evenings).

● National Panasonic DR49 full communication receiver, LW MW FM SW, full coverage to 30MHz USB LSB CW, two speed drive giving fabulous bandspread. Mains/battery. Mint condition £195. Trio Kenwood R1000, fully synthesised 150kc-30MHz, built-in 24 hour clock timer, new condition, bargain £198. SX200N VHF UHF scanner 26-88, 108-180, 380-514, AM/FM throughout, new £185. Sony CRF 230 super portable LW to 30MHz plus FM. 61-108 AM, SSB, mains battery, mint £185. Joystick antenna and tuner £12. All plus carriage. Andrews, 12 Malton Way, Clifton, York YO3 6SG. Tel: 0904 59035.

● Electronics Today International, first issue April 1972 to December 1983. Complete £25. ASR33 Teletype Westrex with tape reader, punch and on pedestal £50. Tel: Slough 45939.

● Blank and assembled electronic music printed circuit boards. 2102 Rams. S Singh, 5 Llewellyn Road, Leamington Spa CV31 2BJ.

● Many synthesiser PCBs and guitar effects PCBs, for clearout. 2102 Rams. Send SAE for list and prices. R Sidhu, 94 Galloway Road, London W12 0PJ.

● GEC 26in colour TV, good condition, works OK £50 ono. Maxcom 4E CB rig, plus SWR meter and mag-mount aerial £25. Marconi TF801B AM Signal generator 12-485 MHz £50. Tel: Knockholt (Kent) 33296.

● Rascal RA17 MkII RX with case. Perfect £150. Tel: 0772 600239.

● 1000 Valves, Octal, UX, 4-pin, 5-pin, pre-war British and American types. SAE for lists. 150 240V 12V 2 amp Sec. screen Pri. Sec £1 each, plus postage 30p. Offers for all 150 Transformers. A E Jeffrey, 42 Dennis Road, Padstow, Cornwall PL28 8DF. Tel: Padstow 532723 (after 6.30pm).

● Realistic DX 302 Receiver, 10kHz to 30MHz, LED digital readout, six bands, tuneable preselector, as new £125. Serpent CB rig, legal FM, very good condition £20. Mr Barnett, 137 Ringinglow Road, Great Barr, Birmingham B44 9BN. Tel: 021 360 6510.

● 19, 31, 38 and 62 sets complete less batteries. Good condition. Various remote aerials, cables, leads for 88, 31, 19, 62 sets, mostly new condition. Sundry spare parts for these old sets. Need to dispose, due to lack of space. Sensible offers only please. Mike Buckley, 12 Ranmore Avenue, Croydon CRO 5QA. Tel: 01 654 2582.

● Atom 12k plus 12k, 6522 V1A, printer interface toolkit rom, wordpack rom £95 ono. Also 10-15-20m trapped vertical cushcraft, unused £30 ono. S Larson (GM4CLQ QTHR). Tel: Larkhall 883982.

● DX-TV equipment. Antiference XG14 Wideband UHF aerial £20. Maplin SP100 aerial rotator with control unit £25. Triax 45013 VHF plus UHF 22dB masthead amplifier with PSU £20. Elec mailorder B45HG UHF 20dB setback amp £5. All excellent condition and boxed, as new. D Bird, 5 Dean Road, Woodthorpe, Nottingham NG5 4FJ.

● Yaesu FRG 7000 receiver, 25-30MHz, 3 clocks, timer, LED readout, as new condition £140. Sommeritamp FT767 DX transceiver, 7M35 mike, fitted with CW and AM filters, spare Xtals for 10 meters, in very good condition £325. 160W linear 10/11 meters, solid state, 1 damaged RF device, hence £30. Ray Dann, 59 Meadow Road, Berkhamsted, Herts. Tel: 04427 4240.

● Following Manuals:- Trio KA2000A Stereo amplifier with service Manual £2. BCC mobile TX/RX 69 (DEFG) £2.50. Wilcox-Gay master oscillator, plus Xtal multiplier £2. Trio TR2200G £2. KW Viceroy TX MK2, plus large MK3 circuit £2.50. Yaesu FT200/250 instruction Manual £2.50. New Zealand wireless set ZC1 MkII, working instructions Part 1, 60 pages £2. Surplus radio conversion Manual, Vol 1 1948 BC-342, 348, SCR522 etc. Offers. Technical Manual 1943 BC312N, NX, BC342N, BC314G, BC344D, offers? Wanted, HRO Senior (or similar) Manual. Alan Edwards, G3MBL, 244 Ballards Lane, London N12. Tel: 01 445 4321.

● Icom 240 with scanner, SS-224 Manual, mag mounts antenna and power supply included, £150. Mint condition Apple II+ computer, with hi-res monitor, Manuals, software etc., £500 ono. Tel: 693 3875.

● Kenwood TR 2500 £175. Pioneer 5300 digital car radio cassette, 2 months old, as new, cost £189, sell for £89. Sharp MZ 80K basic, Pascal books, Progs., £189. Tel: 0277 354378 anytime (Essex).

● Eddystone 680X £100, Eddystone 880/2 £285, Hallicrafters S27 modified £50, Hallicrafters S72 £50, Pye PTZ 704 £15, Hudson with ZM synthesizer, £50. Tel: Wokingham 782236.

● Electronics course, Heathkit, plus ET 3100 trainer console. Current model, Mint condition £60, or split, (cost £120). Philips 2202 mono cassette recorder plus accessories £10. Tel: 01-794 5879 (evenings).

● Video recorder Akai VS-9700 £90, Q-Meter, Marconi TF 329G £30, AM/FM signal generator, Taylor 62A MkII £50, CRT Tektronix 21-9 £30 (new), Kodak Ektaflex processor £30, Sony H F receiver ICF 2001 £90, Sony S W Receiver ICF 5900W £30, Thandar frequency-counter, PFM200A £40 (new), Heathkit digital multimeter IM-102 £20, Sinclair

digital multimeter DM-2 £10 (not working Ruislip 75769).

● SX200-N Scanning Receiver for sale £16. Tel: 01-485 4251.

● Radio, Realistic DX 200 communication CB equipment, antenna G-P.A4 Coax, £14. power pack, 13.8V-3A, £10. S W R and indicator, £8. Power amplifier, B30W £10. T. 593 3159 Dagenham, Essex.

● LS102 Belcom 10-11 meter mobile trans with power supply, £185. Tel: 0734 883418, 4 pm.

● Philips G6 Hybrid, Thorn 3500, Bush A823 Hybrid, Philips G8, panels spares etc., che clear, or exchange for ultrasonic transducer books etc. on ultrasonics. Tel: Alan on She (0742) 311191 after 5 pm.

● Bearcat 220 scanner receiver, mains/12V -50, 118-136, 144-174, 421-512. MHz, £135.00 0273 516801 (Newhaven) G8RHU.

● Quad 22 control unit, two Quad II p amplifiers and Wharfedale FM tuner, in walnut cabinet with record storage and W/Dale W4 corner console speakers with 4 un each, excellent condition, £135. R Parker, Sherbourne Rd, Blackpool. Tel: Blackpool 25

● New, boxed valves: EB91, D77, 6AL5, CV4014, QZ77, EF91, 8D3, 6AM6, ECC91, CV2 OB2, 108C1, E88CC, 54pence each, inc. P & P Walker, 96 Sunnybank, Hull HU3 1LF, N Humberside.

● Colt Excalibur home base, Lo-Lo Lo, High H bands, USB, LSB, AM, FM. Zetagi 200W amp, Av 3 ELE. beam SWR meter, £300 the lot. Mr J Crai Clintpark, Ecclefechan, Dumfriesshire. Tel: 05 615.

● Clearing out packs of resistors/capacitors/transistors, mixed with some other devices, items £2.50 (2½p each). Miniature pots 22K, li for £1.00. Power pack 13A plug-type, output 100 at 8v DC £2.00. D. Martin, 29 St Johns Cl Leatherhead, Surrey.

● Swan 100 MX transceiver, 80m-10m, mobile base, 180 Watts, very good condition £190 o M.B.A. R.O. C/W. RTTY, as new, screen display decoder, £120 ono. K.W.E-Zee Match, £30, QRP V 7MHz, £5. G W Grieveson, 41 Donegal Park, Be Row, Bury St Edmunds, Suffolk, IP28 8 Tel: 717106 (Mildenhall).

● Yaesu FR 100B 80-10m, 100 KHz calibrat mechanical filter, R.F. antenuator, good con tion, handbook £65 ono, carriage extra. Tel: Bext 215619.

● Heath SB 101 transceiver plus P.S.U., go working order £100. Heath HW 101 used as extern V.F.O for SB101, requires attention for fo operation, with P.S.U. £35. Datong FL2 audio filt £50. R.F.C speech processor £25. Heath HD14 electronic keyer with Hi-mound paddle £15. C AMT, Trevescan, Sennen, Cornwall, Tel: 0736 560.

● Students, learn RAE in your home with hel from our low cost system at Dover YMCA amateur radio club. Information from P J Pennington, 14 Elms Vale Rd., Dover, Kent. CT17 9PN.

● Newnes 'Radio and TV Servicing' manuals in 1 vols 1953 to 1969. 'FM Servicing Handbook', G King 'TV Servicing Handbook', Price/Patchett. 'Practical Electrical Engineer' 5 Vols Newnes. Transisto Pocket Book. Heathkit OS1 Oscilloscope require attention. Sensible offers please. Tel: Birmingham 021 458 5374. (Evenings only).

● Complete 2 metre station. Belcom HC 1400 20 watts FM rig, P S U, A T U, S W R. meter. Tonna ELE Yagi, Butternut co-linear tons of UR 67 with al plugs sockets etc. Also mobile mounts, aerials, Home-brew mobile mike. Offers around £230. Ian, 45 Town Lane, Charlesworth, Sk14 6HQ. Tel: Glossop 62479.

● Broadcast transmitter VHF FM 88 to 108 MHz 80 watts output. Varactor modulation give Hi Fi audio reproduction, perfect for music and speech broadcasting. Will pass stereo if used with encoder. 240 volt mains operation. Fully transistorised, light and easily portable. Very simple to operate. As used by J.F.M. etc. Instructions, information and advice provided. Genuine bargain at £130. Tel: 01-672 8764 evenings (7.30-8.30pm only please).



# FREE READERS SMALL ADS

## WANTED

Wanted Philips Oscilloscope GM3152. Hunts Edge CRB3. Scrap Eddystone receiver 870A. Valves ELL80, PX4, PX25, DA60, and equivalents. Buy or swap large on valves 1930 onwards. P Taylor, 14 Willow Canewdon, Rochford, Essex. SS4 3QH. Tel: 098.

Wanted service manual for JVC colour video recorder, model HR 3330 EG, on loan or for sale. Also circuit diagram for UHF, VHF, TV. A S Murty, PO Box 2825, Safat, Kuwait (Arabian Gulf). Tel: 414572.

Wanted Yaesu FTV901R. Please call 01 958 for an instant deal (G6XGG). Martin Clayton, 17 Wick Ave, Edgeware, Middx.

Wanted service manual or circuit diagram for ferro-series seven, model 713H. Will buy or copy at your price. Robert Allen, 69 Callcott Kilburn, London NW6.

Wanted Philips R-390/A URR receiver, + TIMCO or SSB unit. Will buy or exchange Canoh F-1 5, 50, 135mm optics, case, filters, etc. Also wanted: receiver manuals, books, early Hi-Fi radios, (small), and other equipment of interest. Write offers, to Stig Lundstrom, Lapinkatu 27 E, 35 SF 00180, Helsinki 18, Finland.

Wanted: could anyone supply me with two audio ICs, type HA1389? These are replacements for Decca music centre, No CP100. Tried mail order companies, and Decca. I will pay all costs. Similar - appearance only - to TA7205AP. Mr A Hoyle, 109 Padstow House, Bodmin, Cornwall, Bransholme, Hull HU7 4HD.

Wanted: still required: USA 2 volt battery valves ID7 or ID5, IF5 and IF7. UX equivalents may be acceptable. Tel: Bath 891254.

Wanted: help! I have a Telequipment servicescope 532A with some parts missing. Can I borrow one? Tel: Steve (G8KUX) Odiham (025671) 3281. Disc drives for Nascom or Alome (bare drives). Ch Bridge, 363 Kennington Lane, Vauxhall, London SE11 5QY. Tel: 01 735 1862.

Wanted: 6K ram pack for ZX81. Also Morse tutor software, and any other amateur software. Also black and white portable TV. I have 2 vintage radios (Sh, Pye). VGC for exchange or sale. Patrick Atton, 4 Mansion Avenue, Whitefield, Greater Manchester. M25 7SS. Tel: 061 766 7012.

Wanted: Cushcraft R3 20/15/10 metre vertical antenna. Good ATV suitable HF TX. R T Capps, 309 Victoria Road, Lowestoft, Suffolk. NR33 9LR. Tel: westoft (0502) 65113.

Wanted: Copy of instructions for the Gilfer Mods to the G7. Also front perspex dust cover for FRG7. Any condition. Good price paid. George Tyler, 39 Plar Road, Hanham, Bristol, BS15 3BA. Tel: 0272 7987.

Wanted: IC R70 receiver or YAESU FRG 7700. Must be in very good order. K Edmund, 24 Pryde Ave, Pennyrigg, Midlothian. EH19 2BJ. Tel: 031 660 1679.

Wanted: 'Scope manuals/circuit diagrams for telequipment S32A and D43R oscilloscopes. Able to photocopy. Please ring Leeds (0532) 866897.

Wanted: Sphinx transmitter. Any condition. N J Birkett, The Moorings, Halvarras Rd, Playing Place, Truro. TR3 6HD. Tel: 862575.

Wanted: Computer, which I can expand to copy PROMS onto disk and vice versa, up to 2764, possibly Microtan or Nascom. Also technical advice wanted on above (I have Softy 2). Tel: Mark in 01 732 9165.

Wanted: Grundig or Phillips VCR, preferably working. Milton Keynes area or reasonable travelling distance. M Richardson, 77 North 7th Street, Milton Keynes, Bucks. MK9 2DP. Tel: 03664 602.

Wanted: Small short wave receiver, such as Codar T28 or similar. Marine amateur bands. I have 1948 Eddystone model 670 needs attention not working. Also have brand new Mullard valves for this receiver. Also have Syncrite projector and screen. Would consider exchange for these two items. A W Hyde, 54 The Causeway, Pagham, Bognor Regis, Sussex. PO21 4PG. Tel: Pagham 3256.

Wanted: 603kHz crystal, falling ball sound source, Admiralty wireless manuals 1912, 1920. 24GHz equipment for sale. Mann. Tel: 0223 860150.

Wanted: Mobile amateur radio. Just joined a club, so any basic equipment, transceiver wise, wants to swap

for FM CM 27MHz and ZX81 computer. Willing to pick up if local. Tel: St Helens 815320 anytime.

Any circuit diagrams for ZX Spectrum add-ons, interfaces, ports, joysticks etc. Prefer to photocopy and return, but will purchase. Robert MacDonald, 62 Balmoor Terrace, Peterhead, Grampian AB4 6ES.

For private collection. Old wireless sets made before 1930, complete or not, working or not. Also valves, parts, earphones, speakers etc for early sets, battery or mains. Please send full details with sketch or photo. Good prices offered. Mr Brand, 4 Temple Park Crescent, Edinburgh EH11 1HT. Tel: 031 228 1569.

Mullard QQV03/10 valves wanted for project. Rod McMillan. Tel: 01 445 25080.

TS 8305 CW filters. External VFO. J Wayman (G4DRS), 190 Drove Rd, Biggleswade, Beds SG18 0HP. Tel: Biggleswade 312609 (evenings).

Service manual for Tektronics 545A scope, to borrow, buy or copy. Also scope CRT wanted for Tektronics 502A. Any info on SIFAM 300 series OHM meter. David Dimelow, 1 Gateside Walk, Blackley, Manchester 9, Lancs.

Service manual for JVC model HR3330 eg colour video cassette recorder. At least printed circuit diagram would be appreciated. A S Murty, PO Box 2825, Safat, Kuwait, Arabian Gulf. Tel: 428712.

UHF and VHF converter. Latter to be compatible with FRG 7000. ATU also wanted. Can you help disabled pensioner equip at a reasonable price? Have got the bug. T W Foster, 5 Centre Parade, Kettering, Northants. Tel: 0536 516353.

Selective calling devices for CB. W Webber. Tel: Long Ashton 2811 (Mon-Fri, office hours).

YAESU FRG7 receiver in good condition. Would pay up to £120. Collect if within reasonable distance. Handbook required. May be interested in similar item. Tel: Tony Corbett, Wrexham 757435 (evenings or weekends). Or write to PO Box 97, Wrexham, Clwyd, N Wales.

Trio TS120V HF transceiver. Cash waiting. Accessories also considered for above. Chris Lorek (G4HCL), 11 Bevills Close, Doddington, March, Cambs. Tel: 0354 740672.

Dual beam scope. Also two PSVs 0-30V 1a. Must be in good working order. Also transistor tester. Mr Gagan, 127 Manygates Lane, Wakefield. Tel: 0924 258342.

FM board for FT101 ZD needed urgently. Will pay your price. Tel: 572 8168 (after 6pm).

Black and white portable TV. Must be cheap. Contact Sean McAteer, 82 Woodlands, Gilford, Craigavon, Co Armagh BT63 6JP. Tel: 0702 831569.

Philips AD8067 WMFB4 woofer with Piezo electrical transducer, 40W rms, 20cm diameter and Philips ADO 210/5Q8 5cm diameter midrange. Perhaps someone has these lying around. Price negotiable. Colin Waywood, No 2 Farm Cottages, Kitchen Hall Farm, Harlow, Essex CM17 9BU. Tel: 0279 29531 ext 2213 (9am-5pm).

Swan model 410 frequency control unit. Also Swan model 230-X AC power supply unit. Swan Mark 1 grounded grid linear amplifier. D R Owen, 12 Wolverley Ave, Wollaston, Stourbridge DY8 3PJ.

Service manual for model 8 Mark III avometer. About 12 years old. Contact Mr Dave Evans, 27 Summerhill Rd, Onchan, Isle of Man. Tel: 0624 3634.

I'm looking for CB sets, working but cheap, also TV tank battle game (not computer type). D Martin, 29 St John's Close, Leatherhead, Surrey.

Small oscilloscope, cheap, working or not working. Alan. Tel: (Sheffield) 0742 311191 after 5pm.

Tuning condenser for Wien 5 FM/AM receiver. Post and cost paid. Leslie Johnson, 31 Edward Avenue, Jacksdales, Notts NG16 5LB.

AM, FM broadcast band transmitters. Also TV transmitters, PSU's, modulators, aerials. Buy or exchange for similar, including stereo generator, keys, decks etc. Aleks. Tel: 01 250 0796 (days).

ZX81 printer for spares. Faulty or broken, one will do. A Jaques, 47 Newstead Road, Urmston, Manchester.

Service Manual or Circuit Diagram for Ferrograph series seven seven model 713H. Willing to buy at your price or photocopy. Also the same for breaking. Robert Allen, 69 Callcott Road, Kilburn, London NW6.

Wanted tech. Manual, circuit, info. for electronic organ, Rima orchestra. E Lind, 54 Cowper Close, Welling, Kent DA16 2JT. Tel: 01 304 1262.

Vintage wireless set, preferably with horn speaker, 1920's era, or vintage components to construct same. Also crystal set, same era required by retired radio amateur to refurbish as a project for subsequent shack adornment. Reasonable prices paid. (G3YJF QTHR) Tel: 061 437 7899.

Yaesu transverter modules for 4m and 70cms; type 70TV and 430TV, as used in FTV901R etc. John (G8KAX). Tel: Hornchurch 57782 (early evenings).

Sinclair Spectrum 48K. Three oscilloscopes offered in exchange plus Heathkit metal detector, all in working order. Possible cash adjustment. W H Davis, Gate House, Little Barford, St Neots, Cambs PE19 4YB. Tel: Huntingdon 72480.

Any information on Collins aircraft band RX 51X-2, TX 17L-7. B A Solomon, 43 Amberley Road, Macclesfield, Cheshire SK11 8LX. Tel: 0625 20782.

Single trace 15MHz Scope; also RE signal gen, and audio gen. Any age, any make, any cond, need not work, but must be repairable. Will collect Essex/Kent area. Gordon, 4 Lionel Oxley House, New Road, Grays, Essex RM17 6PP. Tel: 0375 79274 (after office hours).

1296-144MHz Receive converter (microwave modules, with bipolar frontend, or similar). Peter Jones (G8KJTJ). Tel: (Penn) 049481 2439 (evenings or weekends).

14MHz-30MHz Coilpack for National HRO. Must have bands spread. Reasonable price paid. Condition unimportant. A Dermont (G8BGT), Burghfield Common, Berks. Tel: 073 529 2592.

Collins 75A4 Receiver wanted, must be in nice condition. Also Yaesu YO-901 Multiscope. P Sullivan. Tel: Manningtree (Essex) 4336.

MFJ 1020 Active antenna. Details to Mr Roberts, 13 The Chase, Salford, Derby. Tel: Derby 761318.

Valve tester with data and RCA or Hallicrafters valve communication receiver. Condition must be reasonable and working or repairable. Details, price and condition to Leworthy, 147 Church Road, Burgess Hill, West Sussex. Tel: 04446 2544.

Small Marine band TX, cheap. Mike Evans, 41 Great Auther House, London EC1. Tel: 01 251 4950.

Sony ICF6800w or Grundig 3400, can exchange Sony 2000 with power unit, also 12-channel Scanner 2m RX. Findley, 27 Keyter Lane, Barford, Warwick CV35 8EP.

Yaesu FRG7 or Lowe SRX30 Receiver. R Miles, 59 Hungerford Road, Calne, Wilts. Tel: Calne 0249 813024.

Friends who will render assistance in purchase of components, books and journals. Kazeem Olayinka M, 33 Bank-Olemoh Street, Surulere, Lagos, Nigeria.

For Solartron CD513 Solarscope, Manual and/or Circuit Diagram or photostat copy of same. Will buy or pay postage and any costs incurred. Tel: 051 644 6028.

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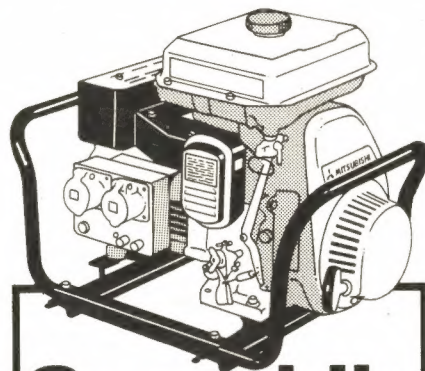
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## Radio & Electronics World

The communications, electronics & computers magazine

## ADVERTISING RATES & INFORMATION

ABC membership approved pending first audit Jan-Dec 1984

DISPLAY AD RATES		series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
61 x 90	1/8 page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	1/4 page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	1/2 page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES		colour rates exclude cost of separations	series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues	
128 x 186 or 263 x 90	1/2 page	£420.00	£395.00	£375.00	£335.00	
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00	

SPECIAL POSITIONS	
Covers:	Outside back cover 20% extra, inside covers 10% extra
Bleed:	10% extra [Bleed area - 307 x 220]
Facing Matter:	15% extra

DEADLINES

\*Dates affected by public holidays

issue	colour & mono display ad	small ad	mono artwork	on sale
May 84.....	15 Mar 84.....	21 Mar 84.....	23 Mar 84.....	13 Apr 84.....
June 84.....	9 Apr 84*.....	16 Apr 84*.....	18 Apr 84*.....	11 May 84.....
Jul 84.....	10 May 84.....	16 May 84.....	18 May 84.....	8 Jun 84.....
Aug 84.....	14 Jun 84.....	20 Jun 84.....	22 Jun 84.....	13 Jul 84.....

CONDITIONS & INFORMATION	
<b>SERIES RATES</b> Series rates also apply when larger or additional space to that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received. A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad series rate contracts are not interchangeable.	If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.  <b>COPY</b> Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations.
Printed — web-offset.  <b>PAYMENT</b> All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by the 15th of the month following invoice date.	Overseas payments by International Money Order. Commission to approved advertising agencies is 10%.  <b>CONDITIONS</b> A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.
<b>FOR FURTHER INFORMATION CONTACT</b> Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE. (0277) 219876	



# NEW YEAR SALE

DISCOUNT DOES NOT APPLY TO 741 & 555

## STORES

8	12p	BC415C	10p	BD243A	55p	MJ2955	90p	TIP3055	70p	2N4033	30p
C	10p	BC416C	10p	BD243C	68p	MJ3000	210p	TIS44	20p	2N4037	40p
4	16p	BC477	25p	BD244A	64p	MJ3001	225p	TIS90	20p	2N4058	10p
6	17p	BC478	23p	BD244C	78p	MJE340	48p	TIS92	20p	2N4059	10p
	28p	BC479	24p	BF180	30p	MJE350	70p	2N1613	30p	2N4060	10p
	32p	BC546	10p	BF181	30p	MJE370	80p	2N1711	30p	2N4061	10p
	29p	BC546B	9p	BF182	30p	MJE371	84p	2N1893	30p	2N4062	10p
	27p	BC547B	9p	BF183	30p	MJE521	68p	2N2218	24p	2N4400	15p
	30p	BC548B	9p	BF184	30p	MJE2955	80p	2N2219	25p	2N4401	15p
	32p	BC549C	9p	BF185	30p	MJE3055	68p	2N221A	25p	2N4402	15p
	32p	BC550C	10p	BF192	12p	MSPA05	20p	2N221A	18p	2N4403	15p
	8p	BC556B	10p	BF196	12p	MSPA06	20p	2N222A	10p	2N4404	15p
1B	9p	BC557B	9p	BF197	12p	MSPA12	22p	2N2368	23p	2N4405	15p
2C	9p	BC558B	9p	BF198	10p	MSPA13	22p	2N2369A	15p	2N4406	15p
3C	15p	BC559B	9p	BF199	12p	MSPA14	23p	2N2482	24p	2N4407	15p
7B	15p	BC559C	9p	BF200	40p	MSPA15	23p	2N2646	48p	2N4408	15p
8C	15p	BC560C	10p	BF224	15p	MSPA16	23p	2N2904	22p	2N4409	15p
9C	15p	BC560C	10p	BF244C	22p	MSPA17	23p	2N2904A	23p	2N4410	15p
12B	9p	BC637	20p	BF245	25p	MSPA18	23p	2N2905	22p	2N4411	15p
13B	9p	BC638	20p	BF256C	32p	MSPA19	23p	2N2906A	22p	2N4412	15p
14B	9p	BC639	22p	BF256LC	35p	MSPA20	23p	2N2907	23p	2N4413	15p
15B	9p	BC640	24p	BF257	32p	MSPA21	23p	2N2907A	23p	2N4414	15p
16B	9p	BCY70	18p	BF258	35p	MSPA22	23p	2N3053	23p	2N4415	15p
17B	9p	BCY71	18p	BF336	36p	MSPA23	23p	2N3054	23p	2N4416	15p
18B	9p	BCY72	17p	BF337	39p	MSPA24	23p	2N3055	50p	2N4417	15p
19B	9p	BD115	50p	BF338	40p	MSPA25	23p	2N3055H	75p	2N4418	15p
20B	9p	BD131	45p	BF339	40p	MSPA26	23p	2N2440	58p	2N4419	15p
21B	9p	BD132	48p	BF340	40p	MSPA27	23p	2N3441	120p	2N4420	15p
22B	9p	BD133	30p	BF341	37p	MSPA28	23p	2N3442	120p	2N4421	15p
23B	9p	BD134	30p	BF342	37p	MSPA29	23p	2N3443	120p	2N4422	15p
24B	9p	BD135	30p	BF343	37p	MSPA30	23p	2N3444	120p	2N4423	15p
25B	9p	BD136	30p	BF344	37p	MSPA31	23p	2N3445	120p	2N4424	15p
26B	9p	BD137	30p	BF345	37p	MSPA32	23p	2N3446	120p	2N4425	15p
27B	9p	BD138	35p	BF346	37p	MSPA33	23p	2N3447	120p	2N4426	15p
28B	9p	BD139	35p	BF347	37p	MSPA34	23p	2N3448	120p	2N4427	15p
29B	9p	BD140	35p	BF348	37p	MSPA35	23p	2N3449	120p	2N4428	15p
30B	9p	BD203	70p	BF349	37p	MSPA36	23p	2N3450	120p	2N4429	15p
31B	9p	BD204	70p	BF350	37p	MSPA37	23p	2N3451	120p	2N4430	15p
32B	9p	BD205	70p	BF351	37p	MSPA38	23p	2N3452	120p	2N4431	15p
33B	9p	BD206	70p	BF352	37p	MSPA39	23p	2N3453	120p	2N4432	15p
34B	9p	BD207	70p	BF353	37p	MSPA40	23p	2N3454	120p	2N4433	15p
35B	9p	BD208	70p	BF354	37p	MSPA41	23p	2N3455	120p	2N4434	15p
36B	9p	BD209	70p	BF355	37p	MSPA42	23p	2N3456	120p	2N4435	15p
37B	9p	BD210	70p	BF356	37p	MSPA43	23p	2N3457	120p	2N4436	15p
38B	9p	BD211	70p	BF357	37p	MSPA44	23p	2N3458	120p	2N4437	15p
39B	9p	BD212	70p	BF358	37p	MSPA45	23p	2N3459	120p	2N4438	15p
40B	9p	BD213	70p	BF359	37p	MSPA46	23p	2N3460	120p	2N4439	15p
41B	9p	BD214	70p	BF360	37p	MSPA47	23p	2N3461	120p	2N4440	15p
42B	9p	BD215	70p	BF361	37p	MSPA48	23p	2N3462	120p	2N4441	15p
43B	9p	BD216	70p	BF362	37p	MSPA49	23p	2N3463	120p	2N4442	15p
44B	9p	BD217	70p	BF363	37p	MSPA50	23p	2N3464	120p	2N4443	15p
45B	9p	BD218	70p	BF364	37p	MSPA51	23p	2N3465	120p	2N4444	15p
46B	9p	BD219	70p	BF365	37p	MSPA52	23p	2N3466	120p	2N4445	15p
47B	9p	BD220	70p	BF366	37p	MSPA53	23p	2N3467	120p	2N4446	15p
48B	9p	BD221	70p	BF367	37p	MSPA54	23p	2N3468	120p	2N4447	15p
49B	9p	BD222	70p	BF368	37p	MSPA55	23p	2N3469	120p	2N4448	15p
50B	9p	BD223	70p	BF369	37p	MSPA56	23p	2N3470	120p	2N4449	15p
51B	9p	BD224	70p	BF370	37p	MSPA57	23p	2N3471	120p	2N4450	15p
52B	9p	BD225	70p	BF371	37p	MSPA58	23p	2N3472	120p	2N4451	15p
53B	9p	BD226	70p	BF372	37p	MSPA59	23p	2N3473	120p	2N4452	15p
54B	9p	BD227	70p	BF373	37p	MSPA60	23p	2N3474	120p	2N4453	15p
55B	9p	BD228	70p	BF374	37p	MSPA61	23p	2N3475	120p	2N4454	15p
56B	9p	BD229	70p	BF375	37p	MSPA62	23p	2N3476	120p	2N4455	15p
57B	9p	BD230	70p	BF376	37p	MSPA63	23p	2N3477	120p	2N4456	15p
58B	9p	BD231	70p	BF377	37p	MSPA64	23p	2N3478	120p	2N4457	15p
59B	9p	BD232	70p	BF378	37p	MSPA65	23p	2N3479	120p	2N4458	15p
60B	9p	BD233	70p	BF379	37p	MSPA66	23p	2N3480	120p	2N4459	15p
61B	9p	BD234	70p	BF380	37p	MSPA67	23p	2N3481	120p	2N4460	15p
62B	9p	BD235	70p	BF381	37p	MSPA68	23p	2N3482	120p	2N4461	15p
63B	9p	BD236	70p	BF382	37p	MSPA69	23p	2N3483	120p	2N4462	15p
64B	9p	BD237	70p	BF383	37p	MSPA70	23p	2N3484	120p	2N4463	15p
65B	9p	BD238	70p	BF384	37p	MSPA71	23p	2N3485	120p	2N4464	15p
66B	9p	BD239	70p	BF385	37p	MSPA72	23p	2N3486	120p	2N4465	15p
67B	9p	BD240	70p	BF386	37p	MSPA73	23p	2N3487	120p	2N4466	15p
68B	9p	BD241	70p	BF387	37p	MSPA74	23p	2N3488	120p	2N4467	15p
69B	9p	BD242	70p	BF388	37p	MSPA75	23p	2N3489	120p	2N4468	15p
70B	9p	BD243	70p	BF389	37p	MSPA76	23p	2N3490	120p	2N4469	15p
71B	9p	BD244	70p	BF390	37p	MSPA77	23p	2N3491	120p	2N4470	15p
72B	9p	BD245	70p	BF391	37p	MSPA78	23p	2N3492	120p	2N4471	15p
73B	9p	BD246	70p	BF392	37p	MSPA79	23p	2N3493	120p	2N4472	15p
74B	9p	BD247	70p	BF393	37p	MSPA80	23p	2N3494	120p	2N4473	15p
75B	9p	BD248	70p	BF394	37p	MSPA81	23p	2N3495	120p	2N4474	15p
76B	9p	BD249	70p	BF395	37p	MSPA82	23p	2N3496	120p	2N4475	15p
77B	9p	BD250	70p	BF396	37p	MSPA83	23p	2N3497	120p	2N4476	15p
78B	9p	BD251	70p	BF397	37p	MSPA84	23p	2N3498	120p	2N4477	15p
79B	9p	BD252	70p	BF398	37p	MSPA85	23p	2N3499	120p	2N4478	15p
80B	9p	BD253	70p	BF399	37p	MSPA86	23p	2N3500	120p	2N4479	15p
81B	9p	BD254	70p	BF400	37p	MSPA87	23p	2N3501	120p	2N4480	15p
82B	9p	BD255	70p	BF401	37p	MSPA88	23p	2N3502	120p	2N4481	15p
83B	9p	BD256	70p	BF402	37p	MSPA89	23p	2N3503	120p	2N4482	15p
84B	9p	BD257	70p	BF403	37p	MSPA90	23p	2N3504	120p	2N4483	15p
85B	9p	BD258	70p	BF404	37p	MSPA91	23p	2N3505	120p	2N4484	15p
86B	9p	BD259	70p	BF405	37p	MSPA92	23p	2N3506	120p	2N4485	15p
87B	9p	BD260	70p	BF406	37p	MSPA93	23p	2N3507	120p	2N4486	15p
88B	9p	BD261	70p	BF407	37p	MSPA94	23p	2N3508	120p	2N4487	15p
89B	9p	BD262	70p	BF408	37p	MSPA95	23p	2N3509	120p	2N4488	15p
90B	9p	BD263	70p	BF409	37p	MSPA96	23p	2N3510	120p	2N4489	15p
91B	9p	BD264	70p	BF410	37p	MSPA97	23p	2N3511	120p	2N4490	15p
92B	9p	BD265	70p	BF411	37p	MSPA98	23p	2N3512	120p	2N4491	15p
93B	9p	BD266	70p	BF412	37p	MSPA99	23p	2N3513	120p	2N4492	15p
94B	9p	BD267	70p	BF413	37p	MSPA100	23p	2N3514	120p	2N4493	15p
95B	9p	BD268	70p	BF414	37p	MSPA101	23p	2N3515	120p	2N4494	15p
96B	9p	BD269	70p	BF415	37p	MSPA102	23p	2N3516	120p	2N4495	15p
97B	9p	BD270	70p	BF416	37p	MSPA103	23p	2N3517	120p	2N4496	15p
98B	9p	BD271	70p	BF417	37p	MSPA104	23p	2N3518	120p	2N4497	15p
99B	9p	BD272	70p	BF418	37p	MSPA105	23p	2N3519	120p	2N4498	15p
100B	9p	BD273	70p	BF419	37p	MSPA106	23p	2N3520	120p	2N4499	15p

## BRIDGE RECTIFIERS

W005	18p
W01	20p
W02	22p
W04	24p
W05	28p
W08	32p
3A/50V	40p
3A/100V	42p
3A/200V	44p
3A/400V	46p
6A/50V	75p
6A/100V	80p
6A/200V	88p
6A/400V	94p
25A/100V	185p
25A/200V	198p



# BEARCAT 200FB — LIMITED NUMBER

## AVAILABLE AT THE OLD PRICE

### £184.95

#### SPECIFICATIONS

**Frequency range:**  
66-88 MHz Low Band  
138-144 MHz Extended VHF Range  
144-148 MHz 2-Meter Amateur  
148-174 MHz High Band  
406-420 MHz Extended UHF Range  
420-450 MHz 70-cm Amateur  
450-470 MHz UHF Band  
470-512 MHz UHF "T" Band

**Size:** 9"W x 3"H x 9 1/2"D

**Weight:** 3 lbs.

**Power Requirements:** 240 Vac, 50 Hz  
(using external wall outlet power supply, included)

**Audio Output:** 800 milliwatts RMS

**Antenna:** Telescoping (supplied)

**Sensitivity:** 1.0µV for 12 dB SINAD

**Scan Rate:** Selectable, 5 or 15 channels per second

**Connectors:** External speaker card edge connector (optional accessory Model No. WH-1)

**Wall outlet power supply.** Plug-in power supply converts standard household current to safe voltages used by radio.

**16 channels.** Program 16 frequencies for automatic scanning in any combination of bands and frequencies.

**Patented Track Tuning.** Extra-patented feature allows scanner to peak on each transmission automatically for optimum reception.

**2 banks.** Activate or lockout groups of channels quickly. Scan channels 1-10, 11-16, or both.

**Priority.** Lets you sample a designated frequency, on Channel 1, every two seconds to prevent missing important calls.

**On/Off Volume.** Power switch and continuously variable volume.

**Automatic squelch control.** Factory set for easier operation or manually adjust to block out unwanted noise.

**Dual scan speed.** Scan at either 5 or 15 channels each second.

**▼ /Limit key.** Sets lower and upper frequency limits for Automatic Search. Also used to "step down" through frequencies in Manual Search.

**Automatic lockout.** By-pass any channel not of current interest for faster scanning cycle.

**Single Antenna.** Single telescopic antenna provides optimized reception without the need for long low band antenna.

**Crystal-free.** Program thousands of frequencies with pushbutton ease... and without a single crystal needed.

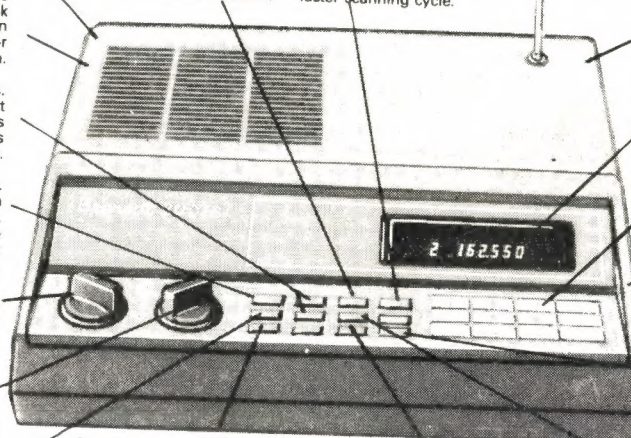
**Decimal display.** Bright vacuum fluorescent display shows frequency being received.

**One piece keyboard.** Sealed keyboard with "key locator" ridges for positive, easy operation.

**8 band coverage.** Includes Low, High, UHF and UHF-"T" bands, 2-meter and 70-centimeter Amateur ("ham") bands, extended Land-Mobile bands.

**Direct channel access.** Go directly to any channel, without stepping through other channels.

**Automatic search.** Seek and find new active frequencies automatically between frequency limits you select.



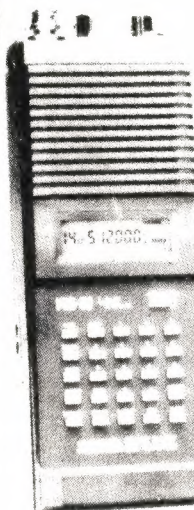
**Patented Selective Scan Delay.** Adds a two-second delay on desired channels to prevent missing transmissions when "calls" and "answers" are on the same frequency.

**▲ /Hold key.** Stops searching action to hold on frequency of interest. Also used to "step up" through frequencies in Manual Search.

## Performance and Value. Bearcat® 200FB

### Direct-Access Keyboard Tuning of 22,884 Frequencies

#### £229.95



Available 15th January, 1984  
Covers 66-88 MHz VHF-Low, 144-148 MHz Ham,  
108-136 MHz AM Aircraft, 138-144 MHz,  
148-174 MHz VHF Hi, 380-450 MHz Ham,  
450-470 MHz UHF-Low, 470-512 MHz UHF-Hi

**Realistic PRO-30.** A full-feature, micro-processor-controlled scanner with extended frequency coverage — in a compact size you can carry wherever you go! Scan up to 16 of your favourite channels continuously, or search a selected frequency range for new or unpublished channels. Scan and Search in two speeds. Two-second Scan Delay, selectable for each channel prevents missed replies. Lockout feature temporarily bypasses unwanted channels. Big LCD display shows channels and frequencies being monitored or programmed as well as the status of the channels. Priority function monitors your favourite frequency while you listen to others. Frequency-tracking front end assures top sensitivity on all bands. Squelch control eliminates noise between messages. Has jacks for external antenna and earphones. With flexible antenna. 7 1/2 x 2 1/8 x 1 1/8". Requires six "AA" batteries or mains or DC adapter. Memory backup requires four silver-oxide batteries. **£229.95**  
Mains Adapter ..... **£6.99**  
DC Adapter ..... **£4.49**

### COLLINS KWM-380 Transceiver



**For the discerning...**  
One of the worlds greatest transceivers  
Listed in U.S.A. at over \$6000.00.  
Talk to us for the bargain of a lifetime, for the transceiver of a lifetime!

**TRS-80 COMPUTERS BY RADIO SHACK**  
DRAKE — TRIO — YAESU — ICOM — FDK — KDK —  
DATONG — HUSTLER — SHURE — ASTATIC — Hy-  
GAIN — TANDY — TELEX — MICROWAVE  
MODULES — HAL — DAVTREND — AVANTI and  
**EVERYTHING ELSE IN AMATEUR RADIO**



## RADIO SHACK LTD

(Just around the corner from West Hampstead Station on the Jubilee Line)  
Giro Account No. 588 7151 Telephone 01-624 7174 Telex: 23718

188 BROADHURST GARDENS,  
LONDON NW6 3AY

